Estimation of energy losses in CESC's T&D network

Prepared for CESC Limited, Kolkata

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Executive summary

Introduction

CESC Limited engaged TERI for undertaking a study on Transmission & Distribution Losses in its franchise area.

Scope

The scope of work covered Review of Methodology followed by CESC for estimating total and disaggregated (technical and non- technical) energy loss. The scope also included review of methodology followed by them for estimating technical energy loss, the report for which was submitted to CESC.

Sample Size

Considering the spread of the Transmission & Distribution network and the need to complete the study within given time frame,representative sample size was finalised for Load Flow Studies and Energy Audit. For this purpose three 132/33 kV Substations along with all 33/6 kV associated substations were selected. In the case of HV (6kV) distribution system, twelve feeders were selected and, for the LT system, three Distribution Transformers were identified for the study.

Methodology Adopted for Sample Study

Total Energy Loss Estimation

The energy delivered into each of the identified three 132kV areas from CESC own generating stations and from neighbouring system is taken as input for a predetermined period. All the energy input/output at each voltage is measured during a specified period. Similarly the aggregate of all the direct consumption at that voltage level is also taken into account corresponding to the specified period. The difference between the input and output readings/aggregated sales at each voltage level gives the net energy lost at that level during the period of study.. These percentage energy losses for each voltage level and for the specified period were extrapolated to compute the annual energy Loss at that voltage level for CESC system.

Technical losses estimation

The technical energy losses of the sample network were estimated by simulating the system on the computer corresponding to the average summer peak load conditions. The peak power losses for each identified sample network were assessed on the basis of Computer Load Flow Studies. The Load Factor and Loss Load Factors (LLF) were worked out from the daily load curves. The peak power loss was then converted into energy loss by applying the Loss Load Factor and the time period of study.

Commercial loss computation

The difference of the total energy loss as obtained from energy audit and the technical energy loss computed from load flow study gives the commercial energy loss.

Results of the sample studies

1. The technical losses in the CESC system are of the order of 9.79%, based on computerised load flow studies. The above does not include distributed losses in the system(losses occurring in pressure coils of meters, fuses, busbars, switch gears etc.) The distributed losses may account for another 1%. Furthermore, the technical losses in the 132 kV overhead transmission line for evacuating power from CESC's Budge-Budge generating station (which account for large part of input energy)will add to this loss. Therefore , CESC's estimate of technical losses of 11.66 % is fairly accurate and reasonable.
2. Based on the study of the sample network, the overall Transmission & Distribution loss works out to be 35.46%, higher than the Transmission & Distribution loss of CESC i.e 22.8 % in 2000-01.The reason for this apparent anomaly is high commercial loss in the LT network of one distribution transformer(Akra Colony O/T), because of large scale hooking from the LT overhead network, as may be seen from the report included in Chapter IV. Such rampant hooking exists only in certain pockets in areas served by Overhead LT Distribution and is not a general trend. CESC's greater part of the LT network is underground. However, it was observed that CESC has got good quality of meters in the identified sample. CESC's total Transmission & Distribution loss (22.8%)is based on 100 % input metering and nearly 100% of the sales (except few street light & temporary connections at Puja Pandals etc). CESC have computerised billing system. Computation and monitoring of Transmission & Distribution loss is a routine function in CESC and is done monthly on an ongoing basis.

3. The difference between overall Transmission & Distribution loss (around 23%) and technical loss (around 12%) is mainly attributable to pilferage. The result of the study indicate that the combined losses upto LT transformation are within guidelines set by the CEA.
4. CESC is alive to the issue of Transmission & Distribution loss and exercise due diligence in mitigating losses (both technical and commercial), the details of which are furnished in Chapter V of the Report. CESC has further intensified loss control drive recently.
5. Pilferage reduction is an issue, which on one hand, needs strong commitment on the side of the Utility and on the other hand, needs strong support from the Police and State Administration, if the effort of Utility has to bear fruit.

1

Introduction and Scope of the Study

Introduction

CESC Limited is the oldest private utility in India and started its operations in 1897. It generates and distributes electricity in and around Calcutta. It has five thermal power generating stations and a vast transmission and distribution network of 13,882 ckt. km. spread over 567 sq. km. area in Calcutta and the adjoining districts. The present generation capacity is 1065 MW and the system's maximum demand was 1238 MW as on March 31st 2001. Power is also imported from other neighbouring utilities. It serves 1.8 million LT consumers and 1734 HT consumers in industrial, commercial and domestic sectors.

Transmission and distribution system is an integral and important part of the electricity supply system. However, in many states, it has generally been neglected and has not received the necessary investment and attention. Experience in many parts of the world demonstrates that it is possible to reduce the transmission and distribution losses in a reasonably short period of time and such investments have a high internal rate of return.

In CESC, the reported T&D losses are of the order of about 22.8 %. CESC has been carrying out energy audit for its system comprising of 132 kV and below network on a routine monthly basis. In order to bifurcate the total T&D losses into its two components, CESC also carries out assessment of technical losses periodically. The first such exercise in this respect was undertaken in the year 1994 and similar exercise was repeated in the year 1997. The latest exercise in determining technical losses in the system was undertaken in February 2000.

CESC is the pioneer in the country in introducing computerised billing system for the consumers.

CESC was also the first utility in India to introduce optical fibre communication, Geographical information system for facilities mapping, SCADA, VHF and Microwave communication. CESC Intranet have also been introduced. The company has also developed an interactive voice response system to provide better service to consumers.

Objectives and scope of the study

With the setting up of a regulatory commission in West Bengal, it has become all the more important to have a pragmatic assessment of T&D losses in CESC system. The correct assessment will have a bearing on the tariff formulation by the commission for the consumers in CESC area.

The findings of this study will help CESC to identify the high loss areas in the system and prioritize the necessary actions required in bringing down the level of losses. This will also have a positive bearing on the financial health of the company.

TERI was engaged by CESC in September 2000 to undertake an independent detailed power system study for realistic estimation of T&D (both technical and commercial) loss in its franchise area for the period 2000- 01. The scope of this study is given below:

Task - I: Review of the methodology adopted by CESC for estimating the technical losses in the CESC system and comments on the same.

Task - II: Estimation of voltage-wise Total and desegregated (technical and non-technical) Energy Losses in CESC System based on representative sample study.

(a) The sample size proposed comprises of three nos. of 132/33 kV sub-stations and all the associated 33/6 kV sub-stations to estimate the total and desegregatedted technical and non-technical losses at the EHT/ HT level.

(b) On medium & LT voltage level, it is proposed to identify total of 12 nos. of 11/6 kV outgoing feeders and all 6/0.4 kV Distribution transformers on each 6kv feeder feeding various consumers at either 400 volts or 220 volts, for the study.

(c) Assessment of non-metered consumption if any in various consumer categories.

(d) Sample check of energy consumption of a representative set of consumers under each category to observe the malfunctioning, if any, of the existing metering arrangements.

(e) Identification of high loss areas.

The report on the Task-I covering our observations on the “approach and methodology followed by CESC for estimation of technical losses” has already been submitted to CESC. The present report covers Task-II of the scope of works.

2

Approach for T & D loss estimation

The energy audit approach is followed for determining the total losses. In this approach the total energy losses in the system are estimated based on the total input energy and metered consumption including the energy exports, if any, in the identified sample, for a specified period. However, the determination of technical losses in the selected network is fairly complicated approach. It is worked out by simulating the network on the computer and carrying out the power system studies corresponding to peak conditions. The basis for choosing a representative sample and average peak condition is described in detail below:

Selection of the representative sample

The CESC system has total of 11 nos. of 132/33 kV sub-stations, 72 nos. of 33/11/6 kV sub-stations. The network also has about 4200 nos. of 11/6/0.4 kV distribution transformers. In terms of lines/feeders, there are total of thirty four 132 kV lines, one hundred and ninety 33 kV lines and 1137 numbers of 11/6 kV feeders. In view of the large size of the C system especially at lower voltage, it was not feasible to determine the losses considering all the elements in the system.

Therefore, sample stratification approach is adopted in which a part of the entire network is chosen which best describes the characteristics of the entire system for assessment of losses. This then is used to arrive at the overall system losses in the whole area. Due care has been taken while selecting the sample network such that it represents all major consumer categories i.e. domestic, commercial, industrial and combined domestic/commercial, geographically spread over the entire CESC's licensee area. All the feeders are categorized either as domestic, commercial, industrial and mixed depending upon the predominant category of load. Similarly, the 3 selected 132/33 kV sub-stations also conform to this logic i.e. each 132/33 kV sub-station is catering predominantly to a particular class of consumers. The HT sub-stations, lines and feeders were selected in consultation with the CESC authorities keeping in view the nature of load and criteria as discussed above.

Accordingly as per the ToR the following sample size was selected and finalized after detailed discussions with CESC.

(a)132 kV sub-stations

1. **Southern 132 kV area** (132/33 Southern Receiving Station) – represents predominantly domestic load
2. **Belur 132 kV area** (Belur 132/33 kV Sub-station) – represents industrial load
3. **Park Lane 132 kV area** (Park Lane 132/33 kV sub-station) – represents domestic and commercial loads

(b)132 kV lines covered

The following 132 kV lines were covered in the selected Southern, Park Lane and Belur area:

Between WBSEB (Howrah) and Southern

4. 132 WBH1 to 132 SRS2
5. 132 WBH2 to 132 SRS5
6. 132 WBH3 to 132 SRS7

Between Majerhat and Southern

7. 132 MAJ2 to 132 SRS1
8. 132 MAJ1 to 132 SRS8

Between Park Lane and Majerhat

9. 132 MAJ1 to 132 PLN1

Between Park Lane and Prinsep Street

10. 132 PRS1 to 132 PLN4

(C) 33 kV lines covered (43)

Park Lane – Auckland Square (double circuit)
Park Lane – Park Circus (single circuit)
Park Lane – Marquis Street (single circuit)
Belur receiving station – New Cossipore (double circuit)

Belur receiving station – Howrah North (single circuit)
Belur receiving station – F. Shore Road (double circuit)
Belur receiving station – Lillooah (double circuit)
Belur receiving station – Bally (single circuit)
Belur receiving station – Howrah Central (double circuit)
Belur receiving station – Indal (double circuit)
Southern receiving station – Alipore (single circuit)
Southern receiving station – L/A at Raja Sant. R/S (single circuit)
Southern Receiving Station – Hide Road (single circuit)
L/A at Raja Sant. R/S – Alipore (single circuit)
Southern receiving station – L/A at Taratala (single circuit)
L/A at Taratala – Akra (single circuit)
Southern receiving station – Taratala (double circuit)
Southern receiving station – Elgin Road (single circuit)
Southern receiving station – L/A3 at Kidderpore (single circuit)
Southern receiving station – L/A5 at Kidderpore (single circuit)
Southern receiving station – MTP2 (single circuit)
Southern receiving station – Budge Budge (single circuit)
Southern receiving station – L/A Outdoor Yard Taratala (single circuit)
OutdoorYard Taratala – Budge Budge (single circuit)
GKW – L/A 9 at HRS (single circuit)
L/A9 at HRS – Shalimar (single circuit)
L/A 9 at HRS – SRS (single circuit)
GKW – Howrah receiving station (single circuit)
Howrah receiving station – Howrah West (single circuit)
Southern receiving station – Shalimar (single circuit)
Southern receiving station – Shalimar via HRS (single circuit)
Southern receiving station – Howrah West (single circuit)
Southern receiving station–Howrah West via HRS (single circuit)

The one line diagrams of selected Southern, Belur and Park Lane 132 kV area is attached in Annex 1.

(d) 6 kV feeders covered

Table 1: List of 6 kV feeders selected for the study

S. No.	Feeder name	Category
1	L/C At Ganguly Bagan T/H (mainly domestic load)	Domestic
2	Akra Clony T/H (mainly domestic load)	Domestic

3	Chandalpara S/H1/Sree Hanuman J.M	Industrial
4	J.N. Mukherjee Road T/H No. 1	Industrial
5	Sree Ambica J.M/British India R.M	Industrial
6	Howrah Auto Telephone Exchange (NS)	Industrial
7	Sarvamangala Prop/Canning St. (W) P/T	Commercial
8	Park Street (W) T/H	Commercial
9	3 Way L/C No. 1 At Hide Road D/S	Industrial
10	National Insulated Cable	Industrial
11	United Bank of India F2	Commercial
12	Lake North T/H	Domestic

The one line diagrams of above 6 kV feeders is attached in Annex 2.

(e) 6/0.4 kV Distribution Transformers

Since, on an average each 6 kV feeder have 6-10 numbers of 6/0.4 kV distribution transformer, it was not feasible to cover all the DTs of the selected 6 kV feeder for LT loss determination. The task becomes even more difficult in the case of distribution transformer, which caters largely to domestic consumers, as there may be typically 200-400 consumers on each such transformer. The computer simulation of extensive LT network connected with such distribution transformers is time consuming and also involves measurement of initial and final readings of energy consumption for each consumer during the period of study.

Another difficulty, which is generally encountered in most of the state and private utilities, is that the commercial staff does not maintain the transformer-wise consumer details. It is quite common in distribution that some of the consumers receiving their power supply from the same i.e. distribution transformer are under the jurisdiction of one distribution staff and the remaining may be looked after by other distribution staff. Therefore, the same meter reader does not go to take the monthly/bi-monthly (as the case may be) meter readings of all the consumers connected to any particular DT. Unless, energy consumption readings of all the consumers are collated, it is not possible to know accurately the energy loss between the distribution transformer and the consumer's premises including theft and pilferage.

In CESC the entire area is demarcated into six commercial zones and sometimes the feeders also cross such defined boundaries and thus are read by staff of that zone only. Such practical problems coupled with the time constraints do not allow consideration of all the distribution transformers on the selected feeders for the assessment of LT losses.

The following three distribution transformers were selected for detailed simulation and energy measurements representing domestic, commercial and industrial types of load with fairly large degree of loading.

1. Akra Colony O/T (caters to mainly domestic consumers)
2. Canning Street (W) P/T (caters to mix load but largely commercial)
3. C.L. Missir Road T/H (caters to industrial load)

The area coverage of 3 distribution transformers is shown in Annex 3.

Basis for average system peak demand determination

Technical losses are the function of network parameters and the system loading. Therefore, the first step towards estimation of technical losses is to decide the peak which represents the maximum demand handled by the system at any given point of time. The system demand always vary with time of day, seasons, festive activities and other factors which contributes to the demand etc., it is impossible to workout the upper limit of technical losses by simple energy balance exercise. These are calculated corresponding to the peak attained by the system at a specified time. Normal peak is registered during the months from August to October in the CESC system. However, the highest peak occurs during the Puja festival often on the first day of Puja. The duration of such peaks is normally limited and thus system does not have to carry this demand for considerable time. If technical losses were worked out on the basis of highest peak attained by the system even momentarily, the equivalent energy losses corresponding to this highest peak would then give erroneous losses, not reflecting the actual reality. Therefore, for realistic technical loss estimation, it is desirable to carry out power system studies corresponding to average peak conditions during the year 2000–01. The table below indicates monthly average system peak, which excludes days of major load shedding, Saturday, Sunday and other holidays. The average of monthly peaks from April to October 2000 is taken to arrive at an "average peak" in the CESC system for the study. It is observed from the table given below that the overall "average peak" of the system works out to be 1119.6 MW. Since this is very close to the system peak of 1121 MW observed on 4th August 2000, therefore, this date is taken as the representative peak loading condition for system load flow studies. An analysis of the daily load curves shows that the daily peak is registered in the evening between 1830 to 1930 hours. Therefore, in order to define a precise time for gathering the various line flows in the selected network, the 1900 hours is considered as the final reference time.

Table2: Average system monthly peak of CESC system

Sl.No.	Month	Average System Peak (MW)
1.	April,2000	1058.4
2.	May, 2000	1088.5
3.	June, 2000	1108.5
4.	July,2000	1104.6
5.	August,2000	1132.8
6.	September, 2000	1185.7
7.	October, 2000	1159.5
	Average system Peak	1119.6

Approach for total energy loss estimation

The methodology presently being adopted for estimating the total energy losses by CESC (as detailed in the following paragraphs) was discussed in detail with concerned officials of CESC and was found to be the right approach. The same methodology was therefore adopted for estimating total energy losses in the network selected for sample study. The total annual energy delivered into each of the identified three 132 kV areas from CESC's own generating stations, the gross import if any from WBSEB, and DVC (Damodar Valley Corporation) is taken as an input during the pre determined period. A part of energy imported from WBSEB is delivered back to WBSEB at certain points in the sample system at various voltage levels, which is accounted as export outside the system. All the energy input/output at each voltage level is measured during the specified period. The aggregate of all the direct consumption is also taken. This energy balance is also corrected for export of energy, if any, outside the reference area. The difference between input and output readings/aggregated sales at each voltage level gives the net energy lost at that level during the period of study. The energy sold to all the consumers in the CESC system is mainly based on metered consumption except for the un-metered supply to streetlight in few areas, which is miniscule as compared to total consumption.

Accordingly, the initial and final readings of all the import/export meters installed at various sending/receiving ends of each voltage level above 6 kV under each of the three identified EHT/HT substations were taken down for a predetermined fixed period. The difference of the initial & final meter readings under each element gives the total energy loss in each section of the transmission and sub-transmission line including the transformers. These total energy losses were used to work out the total energy losses in the three identified substations considered together.

For distribution system i.e. 6 kV and below, the total energy losses are computed as a difference of energy sent out from the DT and the energy billed corresponding to predetermined period. These losses are then extrapolated based on the energy available for LT distribution in CESC system to arrive at the annual energy losses for the year.

Approach for technical loss estimation

The technical losses in each element of the identified sample from 132 kV to 6/0.4 kV transformer have been estimated by simulating the identified system on the computer. The ETAP Power station software is used to carry out the Load Flow studies, and to know the power flows (active and reactive), % loading, branch losses (active and reactive), power factor (lagging or leading), voltage regulation etc. corresponding to the peak condition as decided for CESC system. The important technical and operating parameters such as voltage, active and reactive power, generator parameters, transformer impedance and R, X & Y values for cables and lines were used. The network parameters, operating loads and other details are given in Annex 4 to 7.

The network details like length, size of cables, transformer loss figures, cable line parameters (R, X and Y) etc. are well documented. Load readings are available through SCADA for 132 & 33 kV system. All the 33/11/6 kV transformers are fitted with meters and MD (maximum demand) and energy advance are recorded regularly. All 6/11 kV feeder loadings (amperes) are also logged.

Accordingly the technical losses (peak power) for 132 kV, 33kV, 6 kV, 0.4 kV LT lines including 132/33 or 33/132 kV, 33/11/6 kV and 11/6/0.4 kV transformation losses (copper) were based on the computer output sheets for each identified sample network corresponding to the 4th August 2000 peak load conditions. The fixed (iron) losses of transformers were added separately to workout the total losses.

At the HV level, a total of 46 (1074 MVA) 132/33 and 33/11/6 kV transformers of various sizes connected to 132 kV, 33 kV buses have been considered for estimation of transformation losses. Similarly, 59 nos. of 6/0.4 kV distribution transformers of various sizes connected to 12 nos. of 6 kV feeders representing different categories of load has been considered for estimation of transformation loss at MV level.

Due to complexity of the LT distribution network, it was not possible to simulate the LT network including service lines emanating from Akra Colony O/T distribution transformer. Therefore, I^2R methodology was adopted for estimating the technical losses in this case.

However, the dielectric losses have been taken into account only in 132 kV and 33 kV underground cables. Since the 33 kV and the 6kV network in CESC system comprise mainly of 3 core cables, the sheath losses are negligible and have not been considered. Similarly in the case of LT network the dielectric and sheath losses of cables being insignificant, have not been considered.

The CESC system also comprises of DC distribution network but the same has not been included within the scope of the exercise because the DC network being very small and handles less than 2% of the total energy. It has been assumed that the technical loss in DC network is the same as in the AC network. Although, the losses in DC network are lower than that of AC network, this assumption will lead to slightly higher technical losses. Since the size of DC network is very small, the above assumption will not make any significant change and thus is acceptable.

Calculation of LF and LLF

The hourly load variations of all the three 132 kV identified network including the various other intermediate and load buses are plotted corresponding to 4th August 2000. The load factor is defined as the ratio of average load to the maximum load, which is then calculated from these load curves.

Load Factor = Average load/Maximum load

The Loss Load Factor is worked out using the following empirical formula:

LLF = 0.3*LF + 0.7*LF^2

Where LF is the load factor as worked out above.

The study of the various load curves of 132 kV and 33 kV buses shows that there is no significant variation in the load pattern at 132 kV and at 33 kV buses. It is therefore assumed that system load factor at 132 kV buses will also hold good for entire network including of 33 kV buses.

For example, the load factor as determined from the system load pattern in case of Southern 132 kV area works out to be 0.74, while the same when determined as an average of individual load factors is 0.71. Therefore, the above assumption can be safely considered for study. For details refer to Annex 8.

Table 3: LF and LLF of 132 kV systems

	132 kV Park Land System	132 kV Belur System	132 kV Southern
Load Factor	0.64	0.81	0.74
Loss Load Factor	0.48	0.71	0.61

Similarly, the individual load pattern of the 6 kV feeders is used to determine the load factor and the loss load factor in these feeders. The load details corresponding to August 4th for each of twelve 6 kV feeders and calculated value of LF and LLF for the same are given in Annex 9.

Most of the 132/33 kV and 33/11/6 kV sub-stations in the CESC system have SCADA facility. The data acquisition function makes it very easy to obtain time variation of load at various metering points. Only at few sub-stations the data recording is done manually.

The iron losses of transformers are added to the peak losses as obtained by running load flow studies to get the total peak load loss. However, it is only in the transformation losses that load factor is assumed as 100%, as iron losses would always be there if energized even in the absence of load.

Otherwise, the load factor of the system or feeder is taken as per calculation. The LLF as calculated above for various 132 kV system and 6 kV feeders are then used to estimate the equivalent energy losses for the given period from the peak load loss.

Equivalent energy loss = Peak Load Loss * LLF * Duration of study

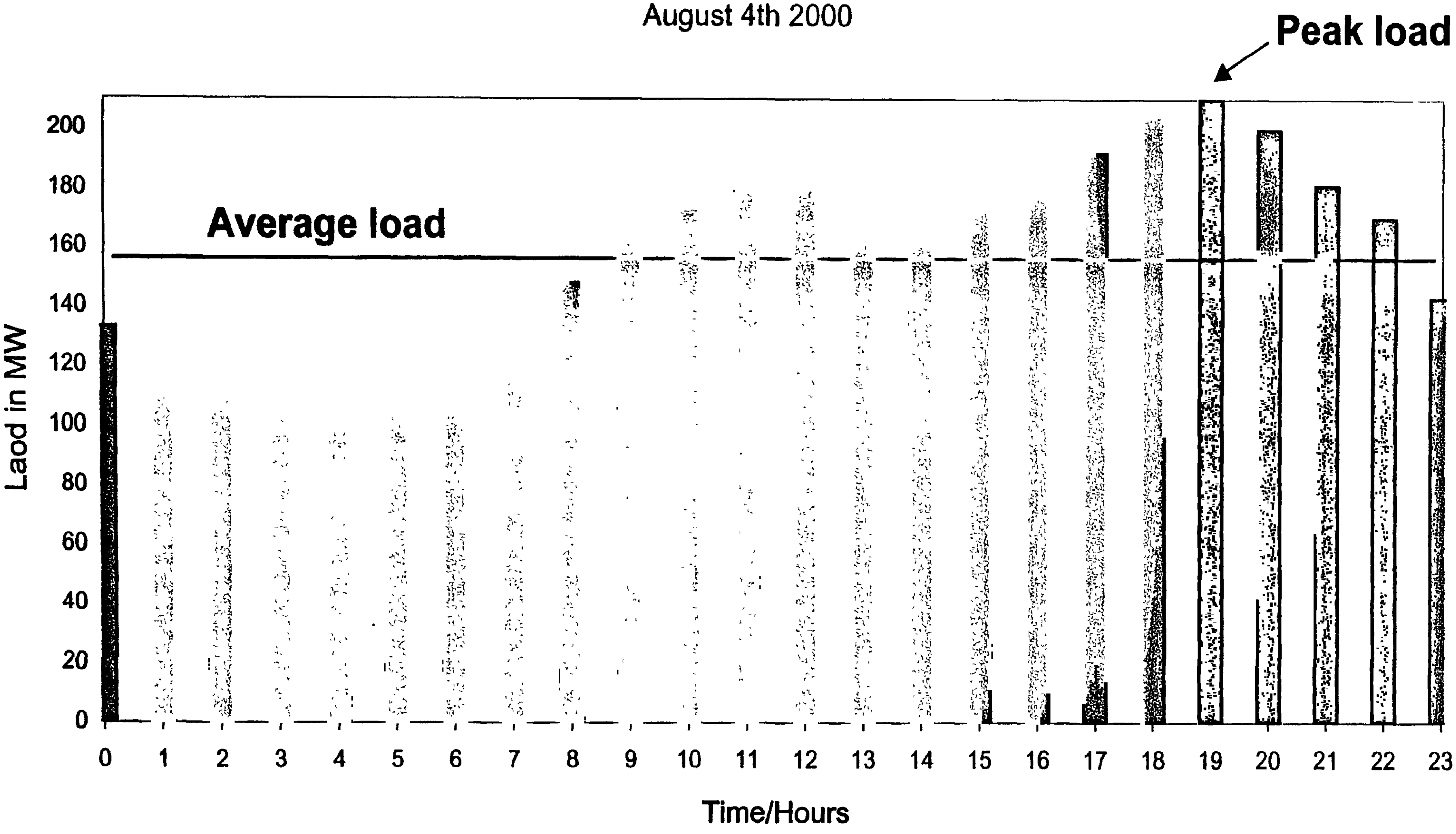
All the energy readings for the 6 kV feeders are prorated for 45 days. Since, the 132 kV system being more complex, involves energy import and export outside the selected network, in order to avoid chances of error, the same is not prorated for 45 days. Thus, for 132 kV system the actual period for which the metering was done is considered.

Computation of Commercial Losses

The Commercial losses have been worked out as the difference of the total energy loss and the Technical energy for each voltage levels.

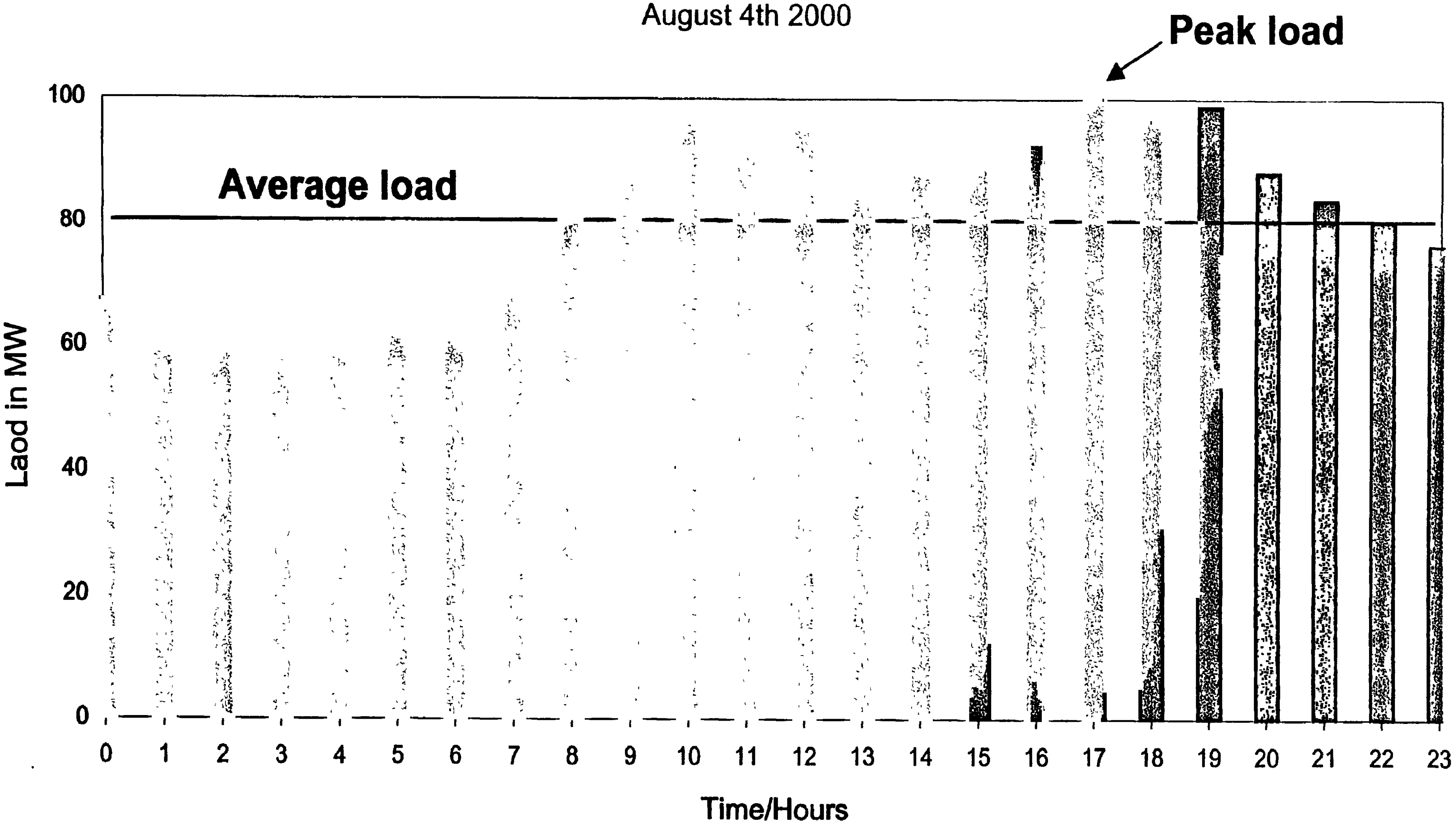
Load Curve of 132 kV Southern System

August 4th 2000



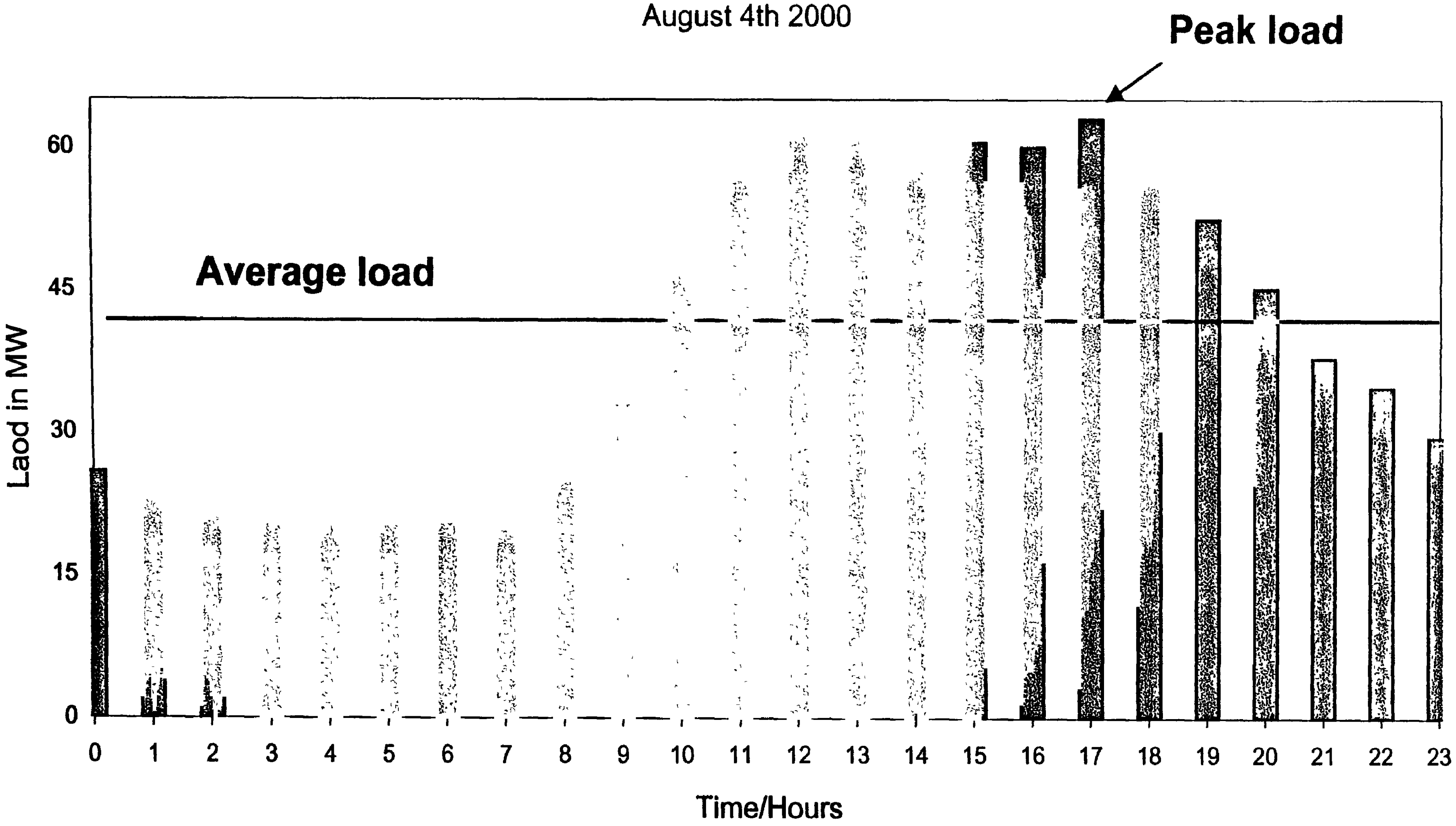
Load Curve of 132 kV Belur System

August 4th 2000



Load Curve of 132 kV Park System

August 4th 2000



3

Results and analysis of T&D losses

Total Losses

HT system losses (132&33 kV system)

The details of energy recorded (received and sent out) at various metering points as identified at each voltage level upto 33 kV including the 33/11/6 kV transformers for Southern, Belur and Park Lane 132 kV system are given in the Annex 10. Analysis of the measured data relating to energy flows both received and sent out during the pre-determined period in the three identified samples, a mismatch between energy sent and received was observed at a few places resulting in negative losses. The prominent reasons for this could be non-calibration of meters or losses falling within the permissible limits of meter error allowed at the HT level. Since most of the meters at HT level are of high-class accuracy with the allowable limit of A2% error, which could lead to mismatch between the meter readings at sending and receiving ends of the lines, hence the chances of negative losses as well. Therefore, the negative losses in such feeders were replaced by actual technical losses based on the simulated system studies.

The result sheets of the Load Flow Studies for Southern, Belur and Park Lane 132 kV selected network are given in Annex 11 (Load Flow).

The relevant summary of results both for "total energy loss" (ref. Annex 10.1 to 10.3) and voltage-wise breakup of total energy loss into "technical and non-technical energy loss" (ref. Annex 11.1 to 11.3) for Southern, Belur and Park Lane 132 kV network are given in table 4.1 to 6.2 below.

In case of Belur 132 kV network, due to non-availability of measurements on the primary side of 132/33 kV transformers at the Belur Receiving Station, the segregation of line and transformation losses was not possible. Therefore, the 132 kV losses in Belur include the 132/33 transformation losses also. In case of Park Lane 132 kV system, Park Lane–Majerhat and Park Lane–Prinsep Street 132 kV lines were not considered in the loss estimation exercise as the energy balance of these two lines were giving negative net resultant energy advance due to metering error

The percentage of total and technical energy loss as calculated in the following tables for these networks are with respect to its own input energy.

Table 4.1: Voltage-wise breakup of HT energy losses for Southern 132 kV system

Energy Flows	Energy input (MkWh)	Energy sentout (MkWh)	Total Energy Loss (MkWh)	% energy loss w.r.t. its own input
A. 132 kV *Lines and transformers*	70147	69245	902	1.29%
B. Export outside the area at 33 kV level	16428			
C. 33 kV Lines and 33/6 kV transformers and station aux.	88703	85798	2904	3.27%
D. Total input the selected network	106032			
E. Total losses in the network *(132/33 kV Tr and 33 kV line and 33/6 kV Tr)*	3806			
F. % Losses w.r.t. to total system input i.e. D	3.59%			

Table 4.2: Voltage-wise breakup of HT energy losses (technical and non-technical) for Southern 132 kV system

Elements of Power System	TOTAL	Losses	
		Technical	Non-technical
A. 132 kV Line and 132/33 kV transformation loss	902	439	463
	0.85%	0.41%	0.44%
B. 33 kV Lines and 33/6 kV transformation loss	2904	2819	85
	2.74%	2.66%	0.08%
Total	3806	3258	548
	3.59%	3.07%	0.52%

Note: The given % losses are w.r.t. total system input

Table 5.1: Voltage-wise breakup of HT energy losses for Park Lane 132 kV system

Energy Flows	Energy input (MkWh)	Energy sentout (MkWh)	Total Energy Loss (MkWh)	% energy loss w.r.t. its own input
A. 132/33 kV transformers	47980	47933	48	0.10%
B. Export outside the area at 132 kV level	7040			
C. 33 kV Lines and 33/6 kV transformers	40893	39236	1656	4.05%
D. Total input the selected network	47980			
E. Total losses in the network *(132/33 kV Tr and 33 kV line and 33/6 kV Tr)*	1704			
F. % Losses w.r.t. to total system input i.e. D	3.55%			

Table 5.2: Voltage-wise breakup of HT energy losses (technical and non-technical) for Park 132 kV system

Elements of Power System	TOTAL	Losses	
		Technical	Non-technical
A. 132/33 kV transformation loss	48	147	-99
	0.10%	0.31%	-0.21%
B. 33 kV Lines and 33/6 kV transformation loss	*1656*	286	*1370*
	3.45%	*0.60%*	*2.86%*
Total	1704	433	1271
	3.55%	*0.90%*	*2.65%*

Note: The given % losses are w.r.t. total system input

Table 6.1: Voltage-wise breakup of HT energy losses for Belur 132 kV system

Energy Flows	Energy input (MkWh)	Energy sentout (MkWh)	Total Energy Loss (MkWh)	% energy loss w.r.t. its own input
A. 132 kV Lines and 132/33 kV Tr	92580	90670	1910	2.06%
B. Import from outside the area at 132 kV level	2168			
C. 33 kV Lines and 33/6 kV transformers	92838	91117	1721	1.85%
D. Total input the selected network	94748			
E. Total losses in the network *(132/33 kV Tr and 33 kV line and 33/6 kV Tr)*	3631			
F. % Losses w.r.t. to total system Input i.e. D	3.83%			

Note: The given % losses are w.r.t. total system input

Table 6.2: Table 5.2: Voltage-wise breakup of HT energy losses (technical and non-technical) for Belur 132 kV system

Elements of Power System	TOTAL	Losses	
		Technical	Non-technical
A. 132 kV Lines and 132/33 kV transformation loss	1910	747	1163
	2.02%	0.79%	1.23%
B. 33 kV Lines and 33/6 kV transformation loss	1721	1283	438
	1.82%	*1.35%*	*0.46%*
Total	3631	2030	1601
	3.83%	*2.14%*	*1.69%*

Note: The given % losses are w.r.t. total system input

A comparison of the total and its breakup for the three systems has been made and results are presented in the following tables.

Table 7 Comparison of voltage-wise HT energy losses for 132 kV systems

Elements of Power System	Southern System	Belur System	Park Lane System
132 kV transmission lines and 132/33 kV transformation losses	0.85%	2.02%	0.10%

33 kV lines and 33/11/6 kV transformation losses	2.74%	1.82%	3.45%
Total losses	3.59%	3.83%	3.55%

Table 8:Comparison of voltage-wise HT technical energy losses for 132 kV systems

Elements of Power System	Southern System	Belur System	Park Lane
132 kV transmission lines and 132/33 kV transformation losses	0.41%	0.79%	0.31%
33 kV lines and 33/11/6 kV transformation losses	2.66%	1.35%	0.60%
Total losses	3.07%	2.14%	0.90%

Table 9: Comparison of voltage-wise HT non-technical energy losses for 132 kV systems

Elements of Power System	Southern System	Belur System	Park Lane
132 kV transmission lines and 132/33 kV transformation losses	0.44%	1.23%	-0.21%
33 kV lines and 33/11/6 kV transformation losses	0.08%	0.46%	2.86%
Total losses	0.52%	1.69%	2.65%

The total energy loss and voltage-wise breakup of total energy losses into technical and non-technical in the sample as a whole is also being calculated and the combined results are tabulated in table 10.1 and 10.2.

Table 10.1: Voltage-wise breakup of HT energy losses of the combined sample

Energy Flows	Energy input (MkWh)	Energy sentout (MkWh)	Total Energy Loss (MkWh)	% energy loss w.r.t. its own input
A. 132 kV Lines and transformers	210707	207848	2859	1.36%
B. Export at 132 kV level	7040			
C. Import at 132 kV level	2168			
D. Export at 33 kV level	16428			
E. Total losses in the network	3631			
F. 33 kV Lines and 33/6 kV transformers and station aux.	222433	216152	6281	2.82%
G. Total input the selected network	248760			
H. Total losses in the network *(132/33 kV Tr and 33 kV line and 33/6 kV Tr)*	9141			
I. % Losses w.r.t. to total input i.e. G	3.67%			

Note: The given % losses are w.r.t. combined system input

Table 10.2: Voltage-wise breakup of HT energy (technical + non-technical) losses of the combined sample

Elements of Power System	TOTAL	Losses	
		Technical	Non-technical
A. 132 kV Line loss and 132/33 kV transformation loss	2860	1333	1527
	1.15%	*0.54%*	*0.61%*
B. 33 kV Lines and 33/6 kV transformation loss	6281	4388	1893
	2.53%	*1.76%*	*0.76%*
Total	9142	5721	3420
	3.67%	*2.30%*	*1.37%*

Note: The given % losses are w.r.t. total system input

The average total, technical and non -technical energy losses in the HT system have been estimated as 1.15%, 0.54% & 0.61% respectively for 132 kV system including transformation losses. In the case of 33kV level these works out to be 2.53%, 1.76% and 0.76% respectively. These percentages are expressed with respect to net input energy to each of the 132 kV system separately, after accounting export, if any.

MV System Losses (6 kV system)

The energy audits of 6 kV feeders require metering at the sub-station (sending end) and at all the source transformers. Therefore, in order to accomplish this task, 1-phase energy meters were installed in all the three phases at LT side on each of the 59 DTs on the 12 selected 6 kV feeders. The entire metering assembly was designed in such a way to avoid chances of tampering by the consumers in that area and was housed inside the pillar-box. The CTs (current transformers) were solidly placed onto the bus bars reducing the chances of its easy removal. The lead lengths were kept to the minimum in order to minimize the chances of meter error.

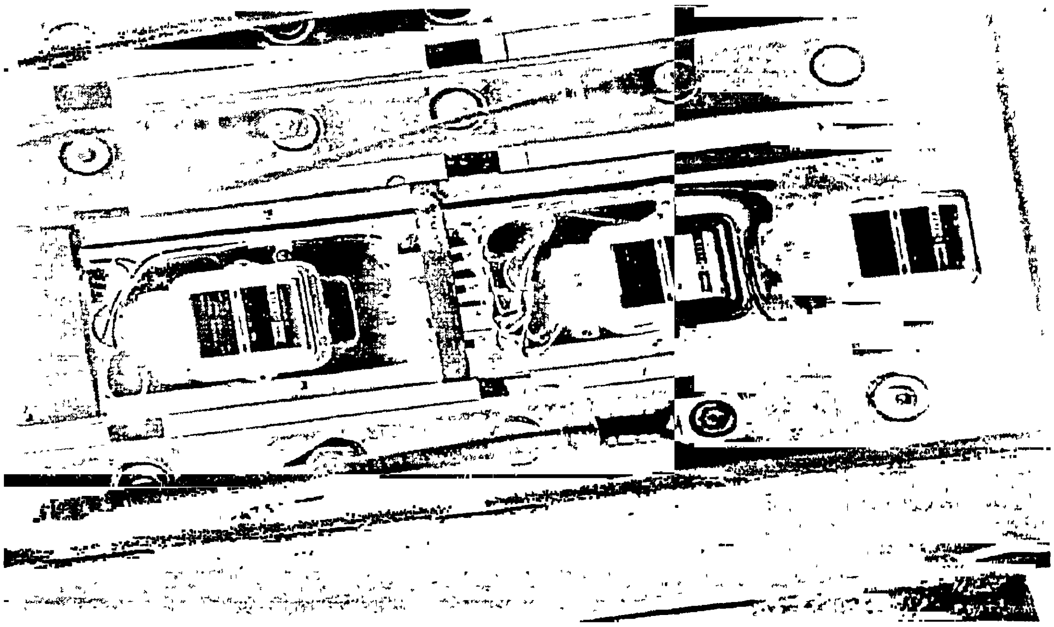


Figure 4: Site showing installed energy meters inside the pillar box at U4, U5 and U6 distributor emanating from Akra Colony O/T 6/0.4 kV Transformer

Earlier, in CESC system all the source transformers were metered, but however, this practice was discontinued later as large number of meters were either damaged or stolen with the apprehension that such energy monitoring and accounting by CESC may lead to necessary actions by the utility. However, during this study, except for few, most of the meters were found operational during the various field visits.

The MV (6 kV) system losses are based on the study of identified sample size of 12 feeders (6 nos. of feeders representing industrial category of load, 3 nos. of domestic and 3 nos. of commercial feeders).

The sending end, energy meter readings of all meters installed at DTs were taken for a specified period of time. The total energy losses were computed as the difference of total energy input and the sum of the energy recorded at all the distribution transformers located on the feeder for a predetermined period. The duration of study was not same for all the 6 kV feeders, and therefore, all the energy advances were pro-rated for 45 days to have an equal weightage of all categories of feeders in the sample. The energy advances for the specified period are given in Annex 12.

The analysis of the results indicates that the total energy losses vary from 2–7% (w.r.t. own input energy). The single figure of total energy losses for all the 12 selected 6 kV feeders is 3.77% (w.r.t. total input energy of all the 12 feeders). The technical losses (power) for the 6 kV feeder were computed by simulating the said feeder corresponding to 4th August 2000 Conditions. The Load Flow results of all the 6 kV feeders are given in Annex 13.

The peak load losses were then converted to technical energy loss by using the LF/LLF of the concerned feeder. The summary of the results is given in the following table 11.

Table 11: Feeder-wise losses (MV system)

	Feeder Name	Distribution Station	Input energy	Energy recorded at DTs	Total Energy Loss	Technical loss	Non-technical Loss
			(kWh)	(kWh)	(kWh)	(kWh)	(kWh)
1	L/C At Ganguly Bagan T/H	Jadavpur D/S	1,260,000	1,224,665	35,335	58,018	-22,683
					2.80%	4.6%	-1.8%
2	Akra Clony T/H	Akra D/S	653,023	632,390	20,633	10,400	10,233
					3.16%	1.6%	1.6%
3	Chandalpara S/H1/Sree Hanuman J.M	Belur D/S	1,149,600	1,077,596	72,004	52,550	19,454
					6.26%	4.6%	1.7%
4	J.N. Mukherjee Road T/H No. 1	Belur D/S	1,165,800	1,108,520	57,281	85,817	-28,537
					4.91%	7.4%	-2.4%
5	Sree Ambica J.M/British India R.M	Belur D/S	685,200	668,162	17,038	28,674	-11,636
					2.49%	4.2%	-1.7%
6	Howrah Auto Telephone Exchange (NS)	Howrah Central D/S	791,017	762,342	28,675	25,024	3,651
					3.63%	3.2%	0.5%
7	Sarvamangala Prop/Canning St. (W) P/T	Jackson Lane D/S	780,988	743,888	37,100	19,321	17,779
					4.75%	2.5%	2.3%
8	Park Street (W) T/H	Park Lane D/S	1,017,529	996,172	21,357	26,708	-5,351
					2.10%	2.6%	-0.5%
9	3 Way L/C No. 1 At D/S	Hide Road D/S	833,538	787,296	46,243	32,713	13,530
					5.55%	3.9%	1.6%
10	National Insulated Cable	Bhatpara D/S	1,016,690	992,514	24,176	9,266	14,909
					2.38%	0.9%	1.5%

11	United Bank of India F2	Prinsep Street D/S	771,353	725,027	46,326	39,215	7,111
					6.01%	5.1%	0.9%
12	Lake North T/H	Ritchie D/S	1,123,984	1,106,088	17,895	28,177	-10,282
					1.59%	2.5%	-0.9%
		Total	11,248,723	10,824,659	424,064	415,885	8,180
		MWH	11,249	10,825	424	416	8

Overall total energy losses in 6 KV system (6 KV feeder + 6/0.4 kv transformer's loss)	**3.77%**
Technical loss (6 KV feeder + 6/0.4 kv transformer's loss)	**3.7%**
Non-technical loss (6 KV feeder + 6/0.4 kv transformer's loss)	**0.07%**

The analysis of the results show the variation in the technical energy loss from 1% to 7.5%. At some of the feeders the technical loss was found to be more than the total energy loss. The factors responsible for such a situation could either be error in metering or the assumed LF, which is very sensitive to technical losses.

The average total and technical energy loss in 6kV feeders was estimated as 3.77% and 3.7%. The difference i.e. 0.07% is attributed to non-technical losses.

LV System losses (0.4 kV cables and Service lines)

The LV losses are based on the detailed sample study of LV System of three 6/0.4 kV Distribution Transformers, each predominantly feeding to either domestic, commercial or industrial consumers. The total energy loss in each of the identified Distribution Transformer is taken as the difference of the total energy input to the 400 volt feeder and the aggregate of billed energy to all consumers for a pre-determined period. All the energy advances were pro-rated for a period of 30 days.

The technical power losses in the LV System were estimated by simulating LT network on the computer (except in case of Akra Colony O/T distribution transformers where I^2R methodology is used).

The energy advances of 3 DTs, load flow results and technical losses are given in Annex 14.

The typical values of R, X and Y used for calculation are given below:

Table 12: Typical values of circuit parameters per kilometer of length

Description	R (ohm)	X (ohm)	Y (mho)
400 sq. mm Al 4-core XLPE cable	0.106	0.040	0.0003768
240 sq. mm Al 3&1/2 core PVC cable	0.171	0.045	.000314
150 sq. mm Al 3&1/2 core PVC cable	0.281	0.05	0.0002826
70 sq. mm Al 3&1/2 core PVC cable	0.605	0.055	0.0002512
25 sq. mm Al 3&1/2 core PVC cable	1.639	0.06	0.0001884
26 sq. mm Al O/H conductor	2.527	0.35	0.0000314
10 sq. mm Al O/H conductor	4.016	0.32	0.0000314
6/1/4.09 ACSR conductor	0.499	0.30	0.0000314

Table 13: Typical values of circuit parameters of service lines per kilometer of length

Cable size	Resistance Phase (ohm/km) Phase	Resistance Neutral (ohm/km)
10 sq. mm	4.02	8.03
25 sq. mm	1.64	3.28
16 sq. mm	2.53	5.05

The technical load loss as calculated through computer simulation and I^2R methodology are converted into equivalent energy losses by assuming a LF/LLF same as that of the associated feeder. The assumed LF/LLF are given in table 15 below:

Table 14: LF and LLF of three distribution transformers

Source Transformer	LF	LLF
Akra Colony O/T	0.64	0.48
C.L Missir Road T/H	0.66	0.5
Canning Street (W) P/T	0.48	0.31

The results of total energy and its breakup into technical and non-technical components are tabulated below:

Table 15: Break-up of LV energy losses for 3 selected DT's

6/0.4 kV Distribution Transformer	Energy Sent out (kWh)	Total Energy Loss (kWh)	Technical loss (kWh)	Non-technical Loss (kWh)
1 Akra Clony O/T	162,197	103,942	13,059	90,883
		64.08%	8.05%	56.03%
2 Canning Street (W) P/T	52,200	4,305	670	3,635
		8.25%	1.28%	6.96%
3 C.L. Missir Road T/H	30,300	4,516	1,440	3,076

		14.90%	4.75%	10.15%
Total	244,679	112,764	15,169	97,595
Total LT energy losses in 0.4 kV network	112,763			
	46.08%			
Technical loss in 0.4 kV network	15,169			
	6.2%			
Non-technical loss in 0.4 kV network	97,595			
	39.9%			

As it is apparent from the results that the LT loses are quite high and are of the order of 46.08% (w.r.t. total input to all the 3 source transformers). Out of this about 6.2% are technical loss and the remainder 39.9% is on account of non-technical losses. The very high LT losses of Akra Colony O/T transformer is resulting in high overall weighted average of LT losses in the sample. It has been told that not every third source transformer or all those source transformers feeding to predominantly domestic load could be characterized by the losses in the Akra Colony O/T.

Thus, it should be considered as an extreme possibility where all the domestic transformers are having the same level of losses as being observed in Akra colony area. It is therefore clear that the Akra Colony O/T may not be a true representative of domestic load in the system.

Projection of losses for the CESC Area as a whole

Based on the voltage-wise total, technical and non -technical losses as worked out from the identified sample size, the annual loss in the CESC System corresponding to the total energy input to the system during the year 2000 – 01 was estimated. The overall level of T&D losses for CESC works out to be about 35.46% with respect to the input to the CESC system. The technical losses are of the order of 9.79% and the balance is attributed to variety of reasons classified as "non-technical" losses. The summary of voltage-wise breakup of losses is given in the table 16.

Table 16: Scenario with Akra Colony O/T

Elements of the Power System	Total Energy Loss	Technical Loss	Non-technical loss
132 kV and 33 kV system	3.67%	2.30	1.37%
6 kV system	3.63%	3.61%	0.02%
LT loss	28.16%	3.88%	24.28%
Overall T&D loss	35.46%	9.74%	25.67%

Note: All percentages are with respect to total CESC input energy

It may be noted that total technical losses of 9.79% are within the permissible limit set out in the guidelines issued by Central Electricity Authority in 1992.

The table below illustrates the computation of losses at various voltage levels for the CESC and its breakup into technical and non-technical components.

Table 17:Computation of total and technical energy losses at HT, MV and LV level for CESC system.

S.No	Particulars	Total Loss		Technical Loss		Non-technical Loss	
		In million kWh	% w.r.t. system input	In million kWh	% w.r.t. system input	In million kWh	% w.r.t. system input
1	Units imported from WBSEB	1216		1216			
2	Units imported from DVC	181		181			
3	Units sent out from BBGS	2940		2940			
4	Units sent out from all other generating stns.	2629		2629			
5	Total systems input (1+2+3+4)	6966		6966			
6	% loss in the HT system (132 and 33 kV level)	3.67%		2.30%			
7	Unit lost in the 132 KV and 33 Kv system	256	3.67% (a)	160	2.30% (d)	95	1.37%
8	Units available for 6 kv distribution(5-7)	6710		6805			
9	% Load loss in 6 Kv distribution including 6/0.4 kV transformation loss	3.77%		3.70%			
10	Unit lost in the 6 kV system	253	3.63% (b)	252	3.61% (e)	2	0.02%
11	Units available after transformation from 6 to 0.4 kV (8-10)	6457		6553			
12	Units sold at 6 KV	2201		2201			
13	LT loss	46.08%		6.20%			
14	Units lost in LV distribution	1961	28.16% (c)	270	3.87% (f)	1691	24.28%
15	Units available for LV sale	2295		4087			
16	Total unit lost (7+10+14)	2470	35.46%	682	9.79%	1788	25.6%

Note:

(1) Item 7(a, b & c) are arrived from the recorded energy advance figures in the selected network.

(2) Item 7(d) covers 132 kV transmission lines, 132/33 kV transformation loss, 33 kV lines and 33/6 kV transformation losses.

(3) Item 10(e) is based on twelve 6 kV feeder after adding fixed losses in DTs on these feeders.

(4) Item 10(f) is the average distribution loss of DTs.

(5) The overall technical loss of CESC system will increase if the losses in the evacuation network of Budge - Budge generating Innovative

station is taken into account. Additionally distributed loss which occurs in various elements of T&D system like in fuses pillar boxes, loop wire and pressure coils of meters, bus bars switch gear CT's PT's is an other component of technical loss and has not been considered in the calculations.

In case of higher voltage network particularly at 132 kV & 33 kV voltage level, there is negligible amount of direct sale and therefore, the 1.37% non-technical losses could largely be attributed to "meter-error".

Unmetered Consumption

During discussion with concerned authorities in the CESC Ltd.,it was learned that no area under their jurisdiction is non metered except few Street Lights where the consumption is billed by the wattage of each point and no. of points. All other Consumers are metered.

4

A report on the spot visit to Akra Colony area

A TERI team led by Dr S K Sarkar and accompanied interalia, by Ms D Basu and Mr. R Das of CESC, visited the Akra colony O/T on August 17, 2001. The objectives of the visit were to observe the extent of illegal hooking from the poles being undertaken by the inhabitants of Akra colony, situated in the West Suburban Fringe of the CESC.

During the study, the team visited Akra Phatak Bazar areas, and residential areas. It also crossed the 'Akra brick making unit' near electric pole at 22/(4/0/9/6). All these places are extensively infected by the system of illegal hookings. Photographs taken during the visit also establishes the fact that there is a rampant theft going on in the Akra colony area.

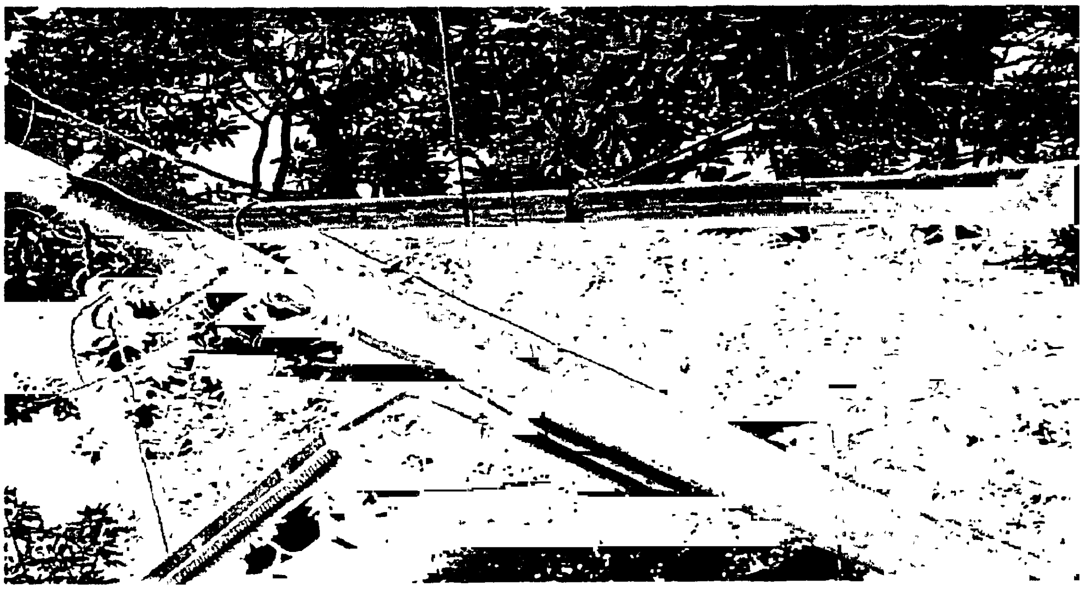


Figure 5: Akra Colony O/T: U5 Area: Illegal Hooking (August 17th 2001, during 12:00–13:00 hours)

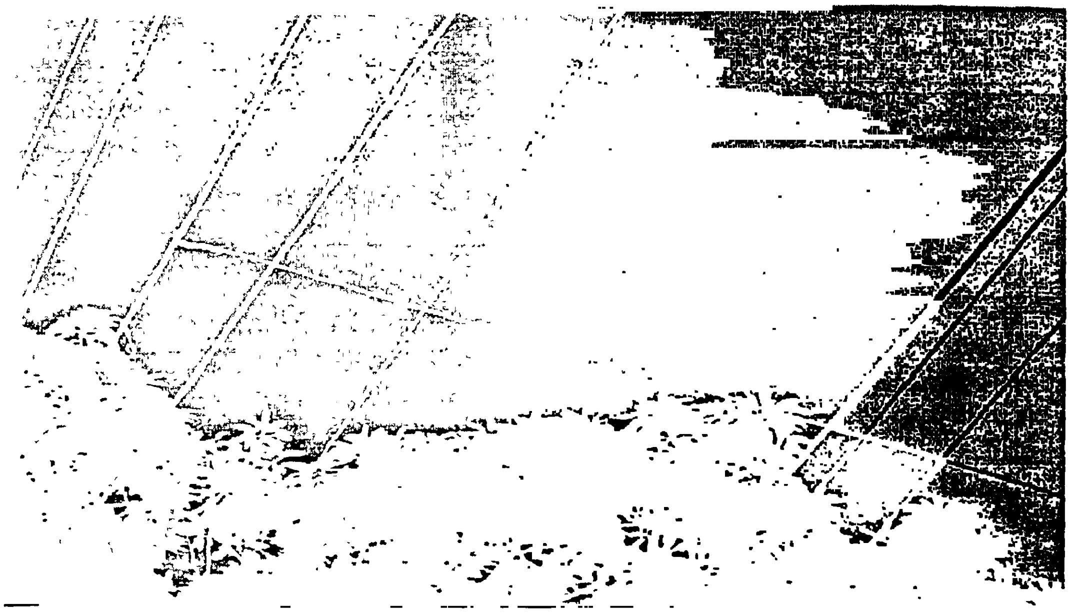


Figure 6: Akra Colony O/T: U5 Area: Illegal Hooking (August 17th 2001, during 12:00–13:00 hours)

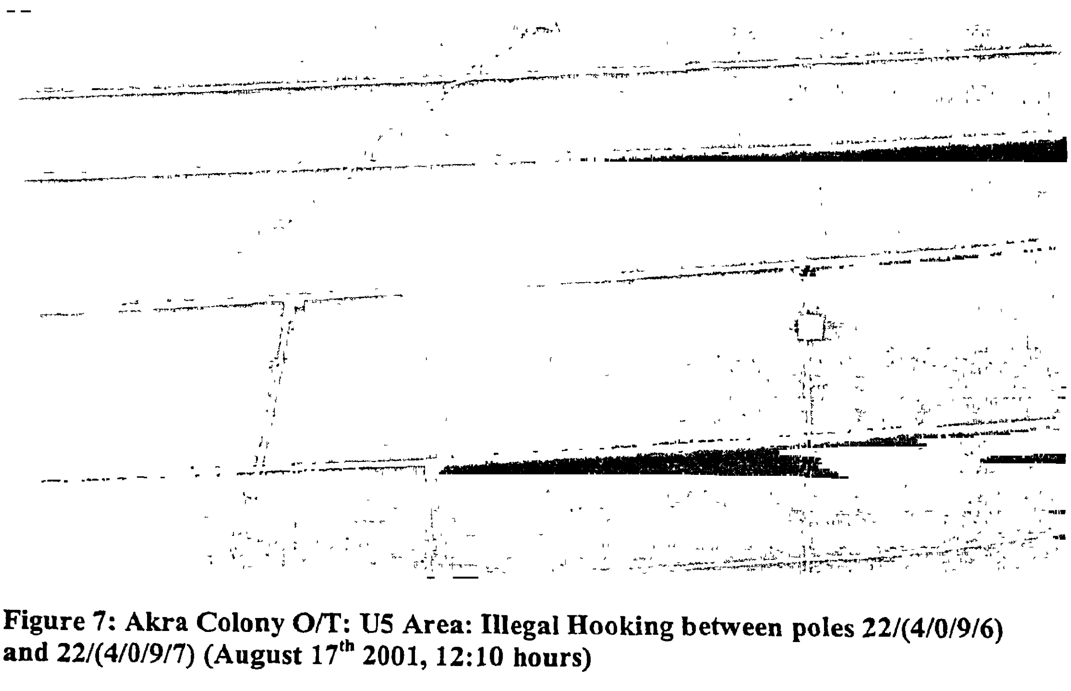


Figure 7: Akra Colony O/T: U5 Area: Illegal Hooking between poles 22/(4/0/9/6) and 22/(4/0/9/7) (August 17th 2001, 12:10 hours)

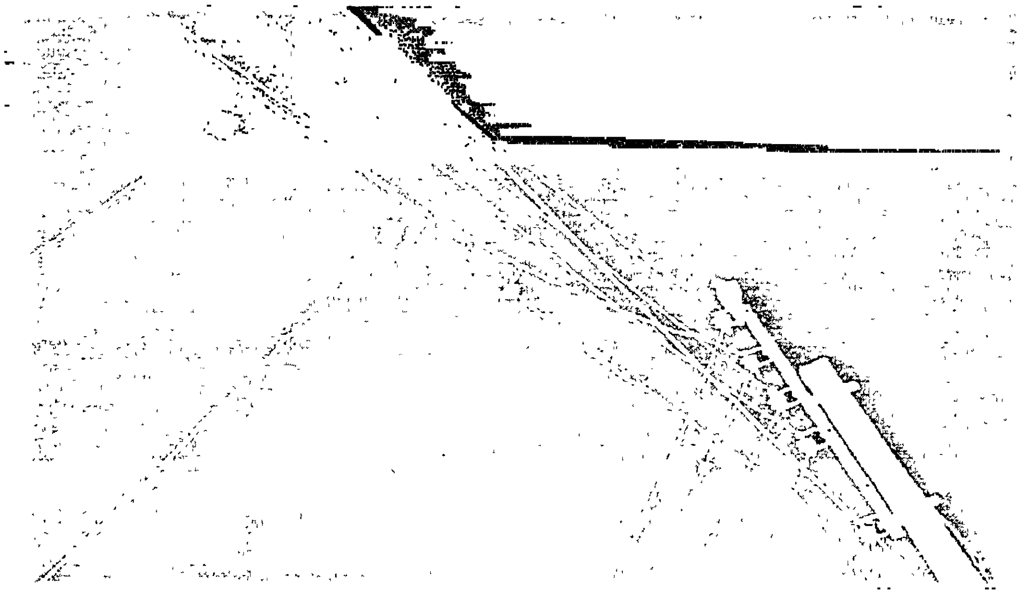


Figure 8: Akra Colony O/T: U5 Area: Illegal Hooking, (August 17th 2001, 12:05 hours)

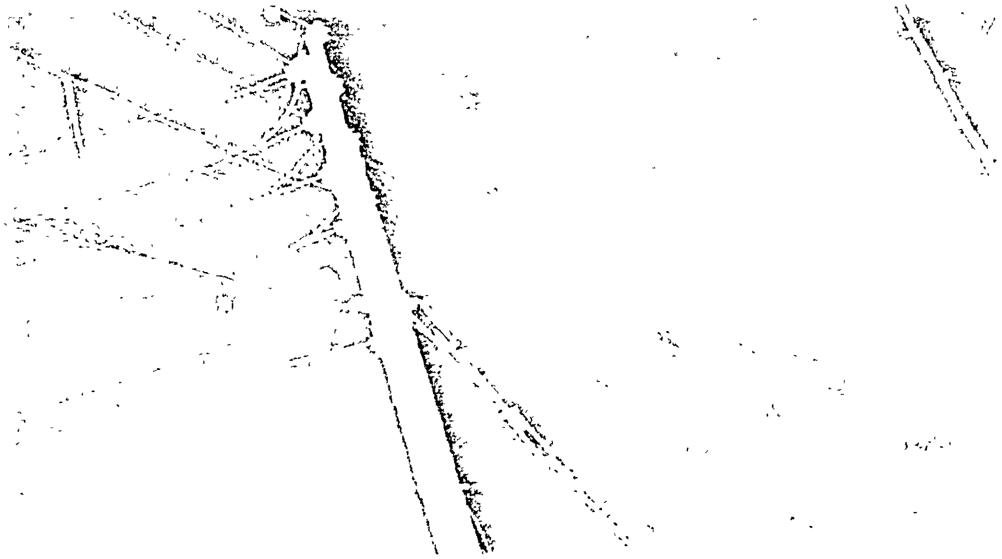


Figure 9: Akra Colony O/T: U5 Area: Illegal Hooking, Pole No. 22/(4/0/9/6) (August 17th 2001, 12:00 hours)

Figure 10: Akra Colony O/T: U5 Area: Illegal Hooking, Pole No. 22/(4/0/9/6) (August 17th 2001, 12:00–13:00 hours)

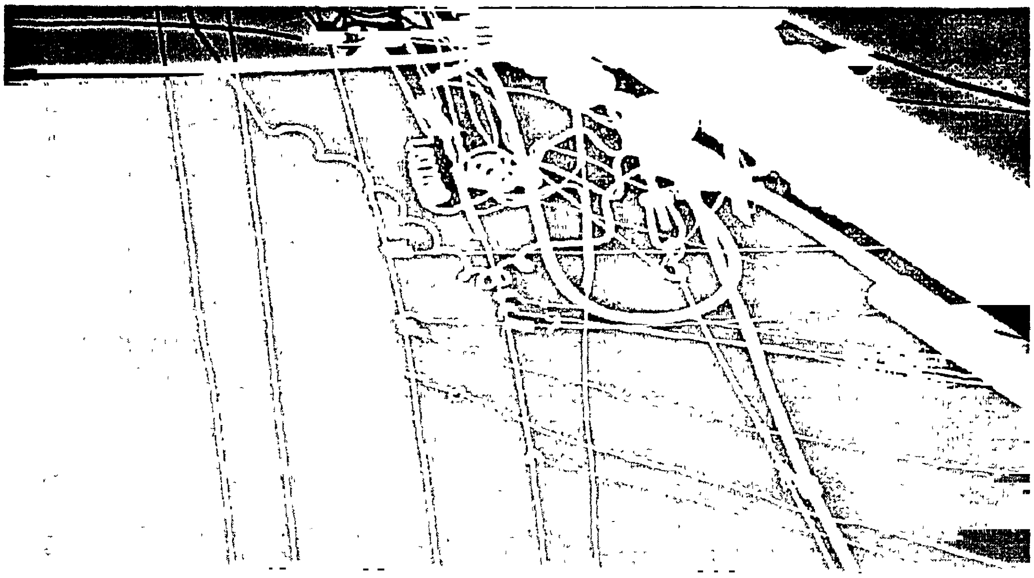


Figure 11: Akra Colony O/T: U5 Area: Illegal Hooking (August 17th 2001, 12:00–13:00 hours)

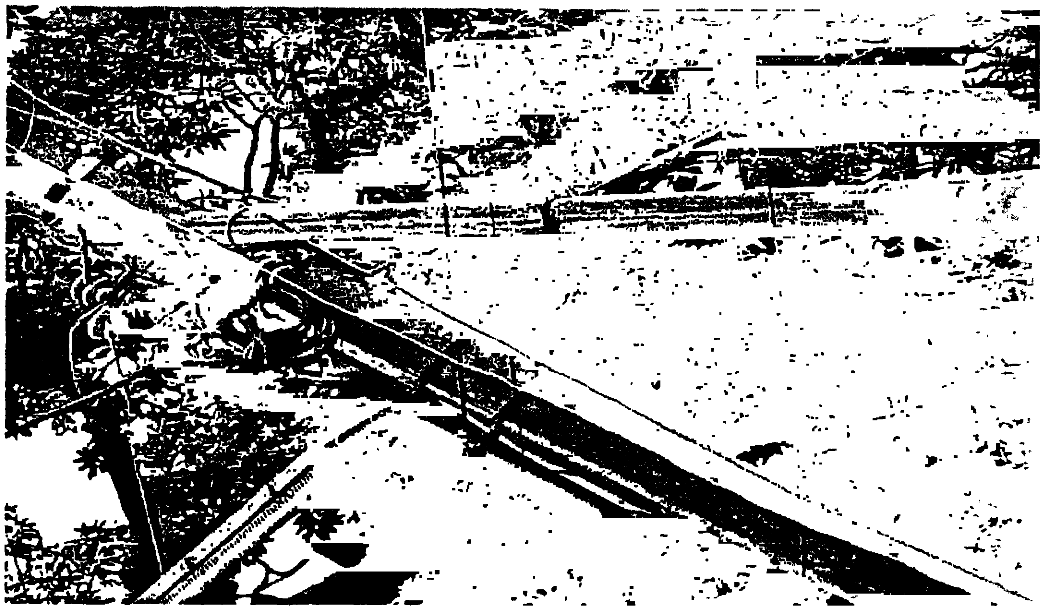


Figure 12: Akra Colony O/T: U5 Area: Illegal Hooking (August 17th 2001, 12:00–13:00 hours)

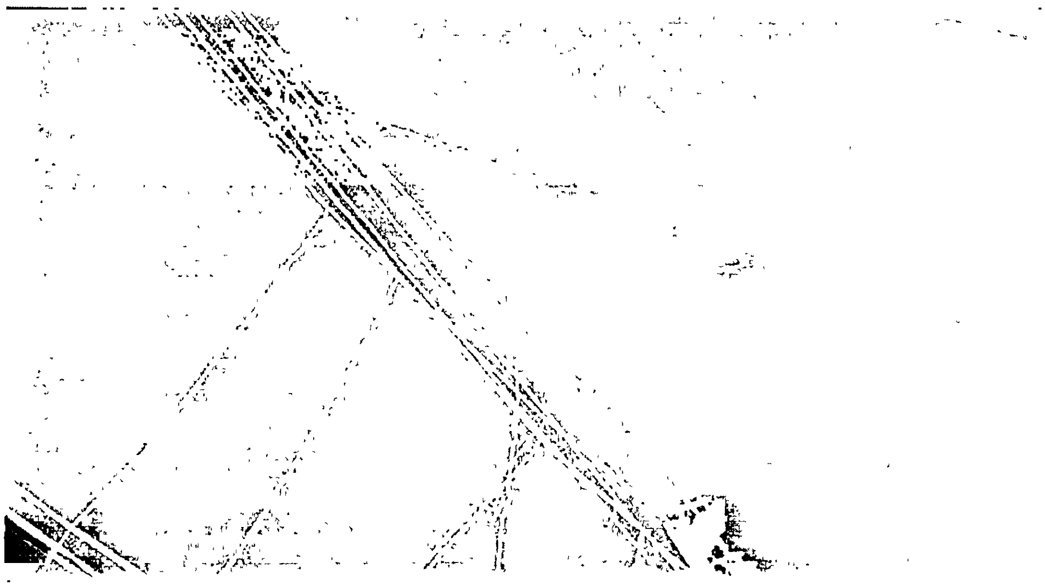


Figure 13: Akra Colony O/T: U5 Area: Illegal Hooking (August 17th 2001, 12:00–13:00 hours)

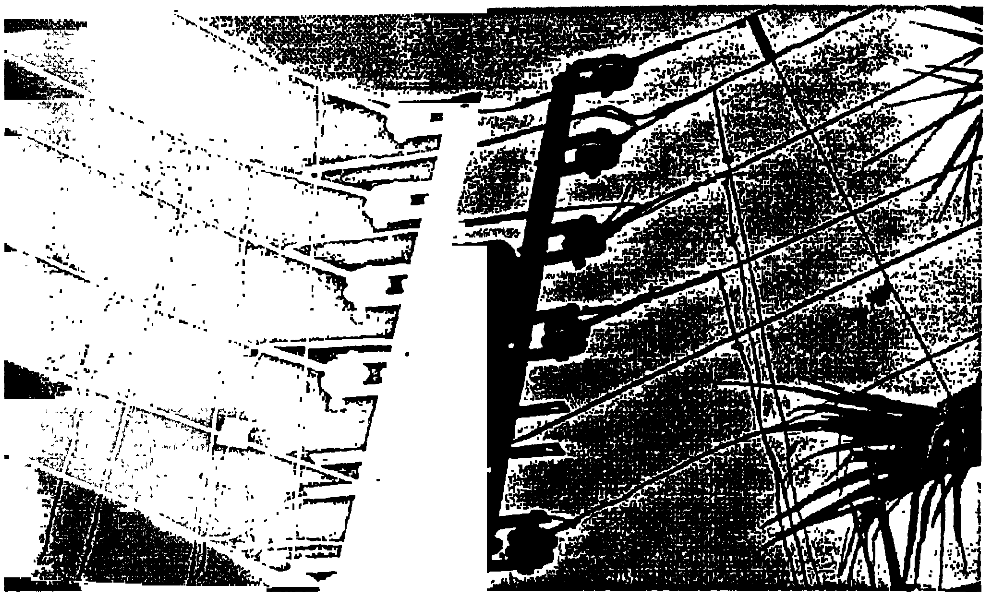


Figure 14: Akra Colony O/T: U5 Area: Illegal Hooking (August 17th 2001, 12:00–13:00 hours)

It is could be seen from the above pictures that illegal drawing of power is not an exception, rather than rule in the area: our visit took place during mid day, and did not affect the resident's behaviour as far as the illegal tapping of power is concerned. While examining such illegal tapping at Pole 22/(4/0/9/6), the team members noticed 12 illegal hooks, and in between this pole and, the pole at Pole 22/(4/0/9/7) there were 15 illegal hooks drawing power from the U5 distributor.

It is reported that approximately 1000 households are involved in the process. Even the market participants are involved in such illegal tapping. The inhabitants, being in the low-income categories, are using the electricity for all purposes: lighting, fanning, refrigeration, entertainment through TV, etc. On an average, a single household using one illegal hook may draw power amounting to about 50-60 units per month. Assuming that 1000 households are involved in the process, at least 50,000 units per month of electricity are not accounted for during the process. In addition, electricity is also being utilized commercially in the market area through illegal means.

During 25/6/01 and 27/7/01, the Akra colony O/T consumed 173,000 units of electricity (covering U4, U5, and U6 line system), against which 58,000 units were registered. Out of these, residential units in U5 alone may account for 50 percent of commercial losses.

At another occasion during the field measurements on the Howrah Auto Telephone Exchange (NS) feeder, it was found that consumers had placed the hookings directly on the bus bars inside the pillbox of Golabari O/T distribution transformer and were stealing electricity in broad daylight. The opening up of the doors of pillar box housing the live bas bars and energy meters also led to a loud explosion as a result of short-circuiting.

Conclusion

It is difficult to believe the magnitude of illegal tapping of electricity, especially when it is undertaken on a massive scale, unless one visits this area. It is true that such a situation did not grow overnight. At this stage, prevention of theft of electricity may require urgent cooperation from the local authorities. They should be sensitized on the need for payment of electricity being drawn and used.

5

CESC'S efforts in reducing losses

CESC'S Efforts in reducing losses

During various discussions held with CESC, and on perusal of some of the documents, it emerged that the utility is alive to the issue of Energy Loss and exercises due diligence in mitigating such losses. It has followed all the relevant recommendations of the CEA as contained in their guide lines issued in 1992 on the subject.

As has already been mentioned, CESC has certain inherited legacies, which stand in its way of reducing both technical and commercial losses. For instance, CESC 's primary distribution system is almost entirely at 6 kv, unlike that in the other Utilities. This has significant contributions to technical loss. Further, CESC has still quite a number of D.C. consumers. While conversion of the 6 kv A.C. primary distribution to D.C. introduces avoidable technical losses, since new D.C. meters are not available in the market, CESC uses vintage D.C. meters, which have outlived their useful life. These meters run slow and often stop registering at all. This adds to CESC's commercial loss arising from unserviceable D.C. meters, for which spares are also not available.
CESC's efforts to control these losses are discussed in brief in the following paragraphs.

Technical Loses

CESC is undertaking reorganization, reinforcement of the network at regular intervals, on the basis of load forecast system planning carried out every year, upgradation of primary distribution voltage from 6 kV to 11 kV, commissioning new 6kv/0.4 kv distribution transformers, both to meet load growth and to reduce the length of feeders and distributors, and installation of capacitors. The major technical reason for increased T&D losses over the years in the CESC system is attributed to increase in power handled at L T Voltage level as compared to HT voltage level. This trend is likely to continue due to anticipated flight of major industries from urban areas because of strict environmental pollution norms as well as recession in traditional industries, which constitute the bulk of the industrial units in CESC 's licensed area.

Commercial Loss

In order to reduce the commercial loss, efforts are directed as follows:-

- *Metering improvement*:-All high voltage bulk consumers as well as majority of large medium voltage consumer have been provided with static intelligent meters which have electronic memory and are temper proof. Further over 80,000 medium voltage consumers have already been replaced by International quality meters. Also, about one third of meters (5.8 lacs) of the total low voltage consumers have already been replaced.

- *Billing mechanism*:- In 1973, CESC computerized the entire billing system. The meter readers are rotated to eliminate error due to meter reading or collusion.with dishonest consumers. Further, for all intelligent meters .the meter readings are downloaded to handheld computers through optical ports and the meter readings are thereafter directly downloaded to the billing computers. Thus, in these cases, which account for the bulk of the energy sold, there is no possibility of any error or mischief.. The whole billing system has been integrated into a comphrensive ERP system.

- *Pilferage Reduction*:- This is a major area of concern of CESC because this loss needs concerted efforts from the utility, administrative, judicial authorities and the society at large for its containment and reduction. The CESC has intensified anti-pilferage activities as described below:-
    1. Scaling improvement: The utility has introduced numbered plastic seals with stainless wire, heliographic seals and crimping type sealing pliers.
    2. Intensive surveillance in the theft prone areas.
    3. Replacement of haze conductors of the overhead distribution network in pilfer prone areas.
    4. Taking up energy audit studies at the L T level where commercial losses are high.
    5. Administrative and legal issues.
    6. A publicity campaign through mailers, road side hoarding, advertisements on TV channels, advertisements in cinema halls, car stickers etc.to creat awareness amongst the public and deterrence in the minds of the consumers, who are pilfering energy.

Inspite of best efforts, theft of electricity is an issue, which remains uncontrollable. This is a social menace and lack of support infrastructure by way of police assistance and inadequacy of legal framework stand in the way. Taking steps against illegal pilferage of electricity is increasingly fraught with danger of being mobiled/assaulted/man-handled. In some case, even the police forces accompanying CESC's engineers have also been manhandled and the police vehicles damaged.
This menace can be controlled only through exemplary punishments penalty etc. CESC is using all such methods to give wide publicity and create awareness through the media.

While the police tryto cooperate with the Utility to tackle pilferage of electricity, the police do not have adequate staff and necessary infrastructure facilities like adequate number of mobile vans etc. Further obviously the police have to give priority to major crimes like murder, communal disturbances, arson, rape bride burning etc. Thus , they are rarely in a position to provide the necessary protection and support to CESC's staff for tackling theft of energy.

Fortunately , after prolonged and consistent efforts of the Utilities in the State over the last six or seven years, the West Bengal Government has recently introduced a Bill to amend the laws to empower the Utilities appropriately and to introduce Electricity Utility Protection Force and Special Courts to deal with the theft of electricity.

Further CESC has long been persuading the State Government to obtain its approval for serving a Notice on D.C. consumers, requesting them to changeover to A.C. within a period of six months, after which D.C. supplies would be withdrawn. It is noted that CESC change over D.C. supplies to A.C. without any cost to consumers. The Utility bears all costs of cabling , installation of service apparatus, commissioning new transformers etc. which are required for the purpose. C essation od D.C. supplies in other cities like Mumbai, Cennai, Patna etc. had been effected by serving similar notices, with the approval of the State Government, decades back. CESC is the only exception.

Meanwhile, CESC is trying to do its best to control the menace of theft of energy in the prevailing circumstances.

6

Conclusions and recommendations

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1. As it is evident from the results that the total technical losses (9.73%) are within the limits set out in the guidelines issued by Central Electricity Authority in 1992. As pointed out earlier the overall technical loss of CESC system will increase if the losses in the evacuation network of Budge - Budge generating station and the distributed loss is taken into account.

2. It is observed that high level of commercial losses in the LT system is mainly attributed to cases like Akra Colony sample. Given the time and financial constraints, the large sample size at the LT level could not be considered. It is however desirable that the sample size of the LT network should be more broad based.

3. It is clearly evident from the results that the commercial losses in the LT system make the overall CESC losses high. However, unless this problem is tackled by launching special anti-pilferage and anti-theft drive in the theft prone areas, it would be difficult to bring down the overall losses to an acceptable limit. We appreciate that this involves major socio - political norms and unless the Utility is armed with the appropriate legislative powers and aided by the State Administration containment of pilferage is difficult since the illegal hooking, if removed in a day, would once again reappear the very next day. The culprit has to be booked.U nless strong actions are taken against such offences, the problem will remain.

4. We understand that that CESC has intensified activities of the vigilance squads. It should be stepped up further.

5. Innovative loss reduction measures such as " incentive award scheme" may be tried.

Under this scheme an employ who brought to light cases of pilferage of energy is rewarded on the basis of the recovery made from the customer. It is learnt that CESC has already mooted such scheme.

6. Severe penalties may be imposed for tampering with the meter seals etc.

7. Energy audit should be introduced and personal responsibility should be fixed on the concerned officials for energy received and energy sales in each area.

8. In case of Akra Colony area, it could be seen from the pictures that the OH bare conductor lines are tapped to supply electricity. In such theft prone areas, it is suggested to convert OH lines to underground cables/OH bunched cables, which will to large extent reduce the chances of placing hooks directly on the bare live OH conductors. The conversion should be done in a phased manner for all such theft prone areas.

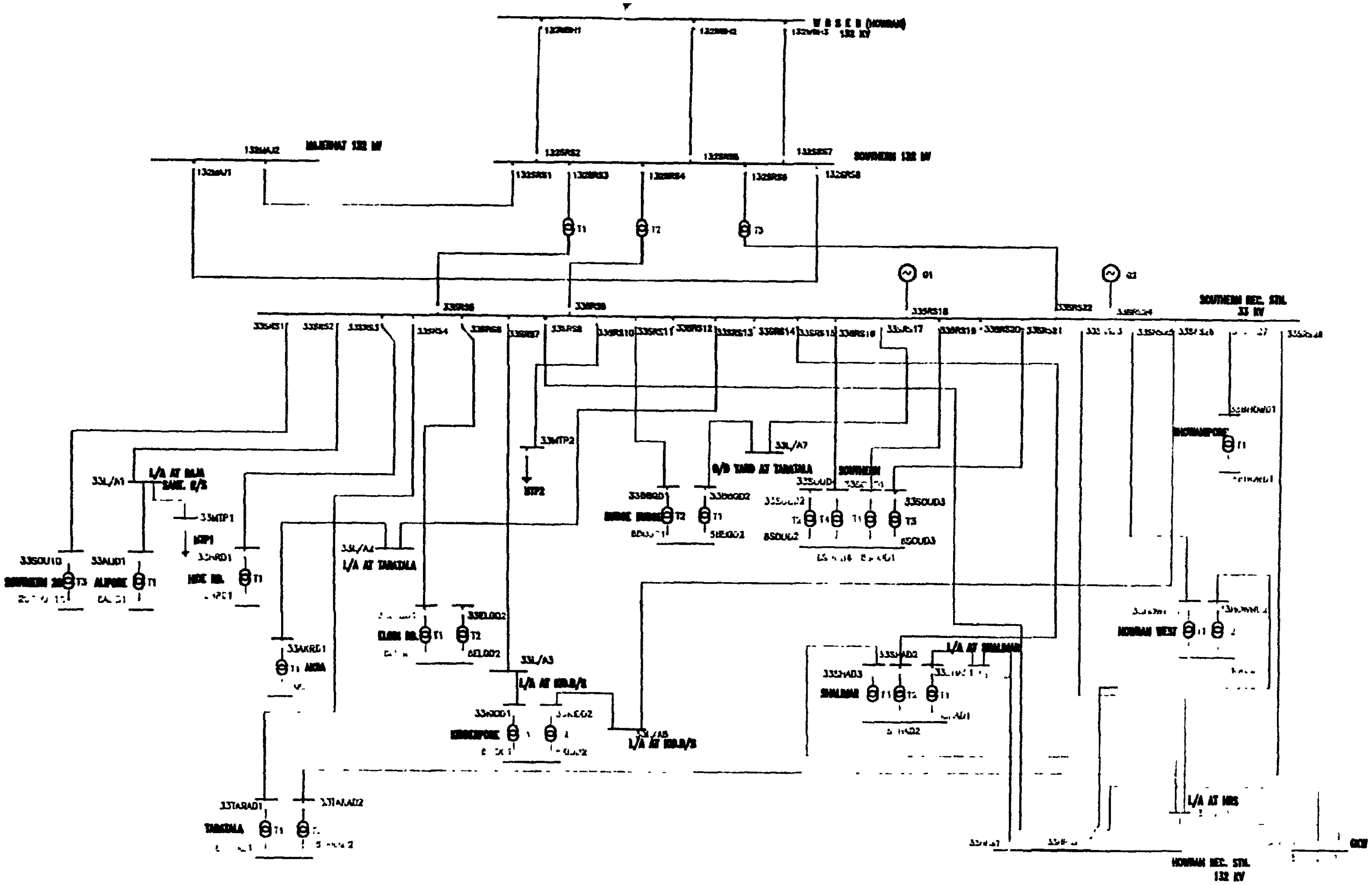
9. Launch public awareness campaigns highlighting illegality of the pilferage/theft at the same time giving tips on how to conserve electricity consumption.

10. Phased replacement of all old electro-magnetic energy meters with good quality meters.

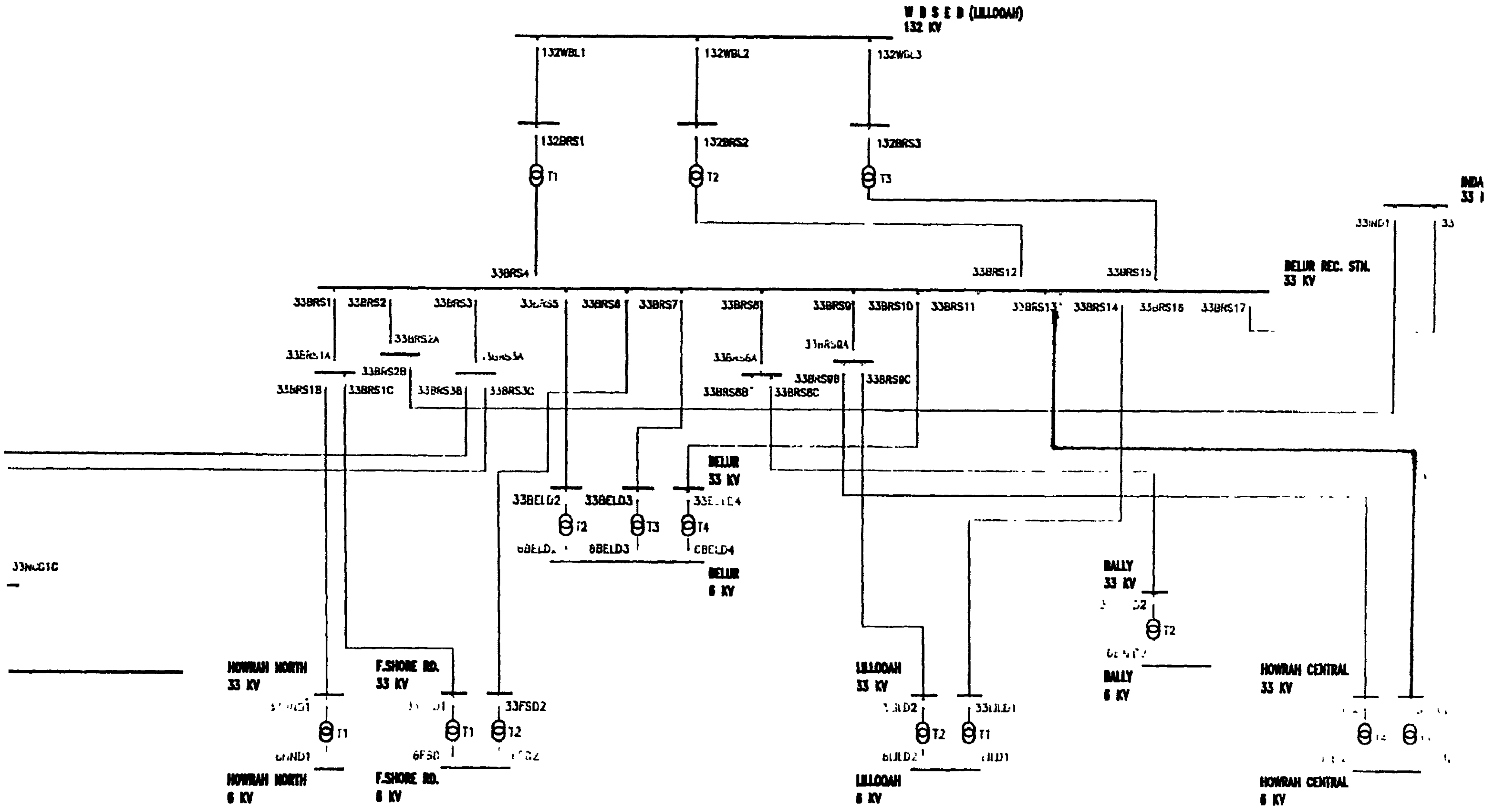
11. . Persuading the State Government to obtain regulatory approval for cessation obsolete D.C. supply..

Annex 1

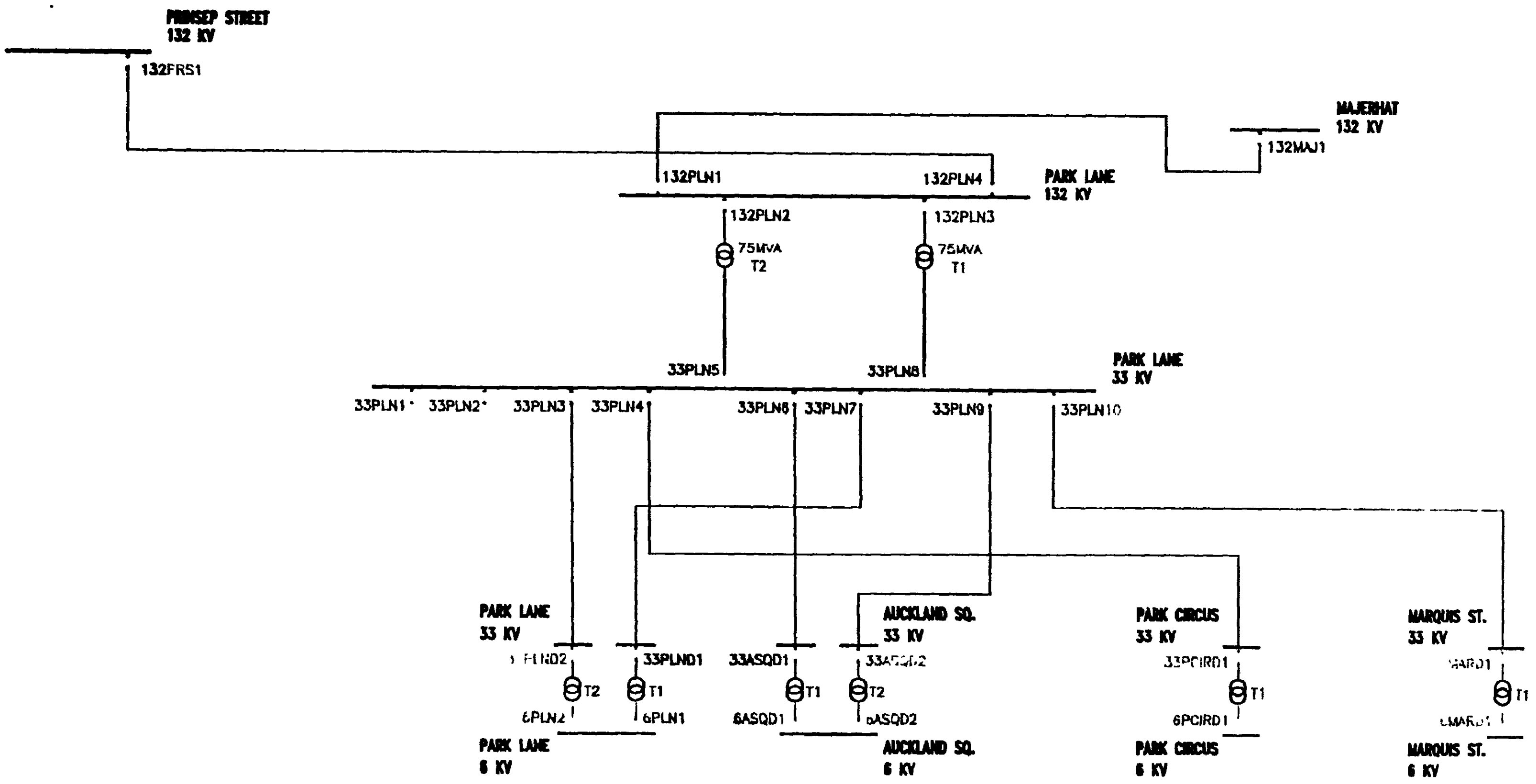
Single Line Diagram of 132 kV Southern, Belur and Park Lane System



SOUTHERN 132 KV. AREA



BELUR 132 KV. AREA

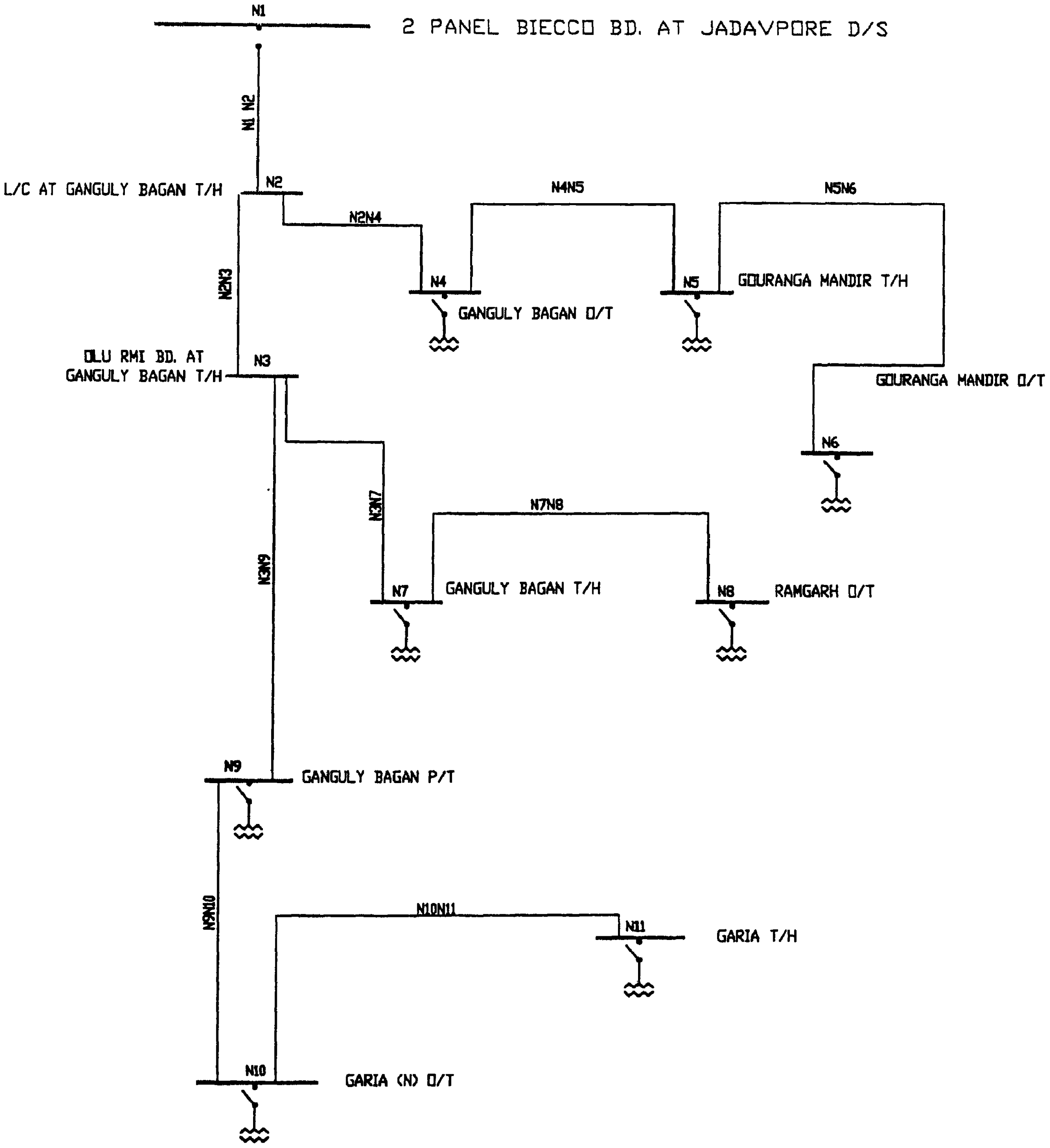


PARK LANE 132 KV.

Annex 2

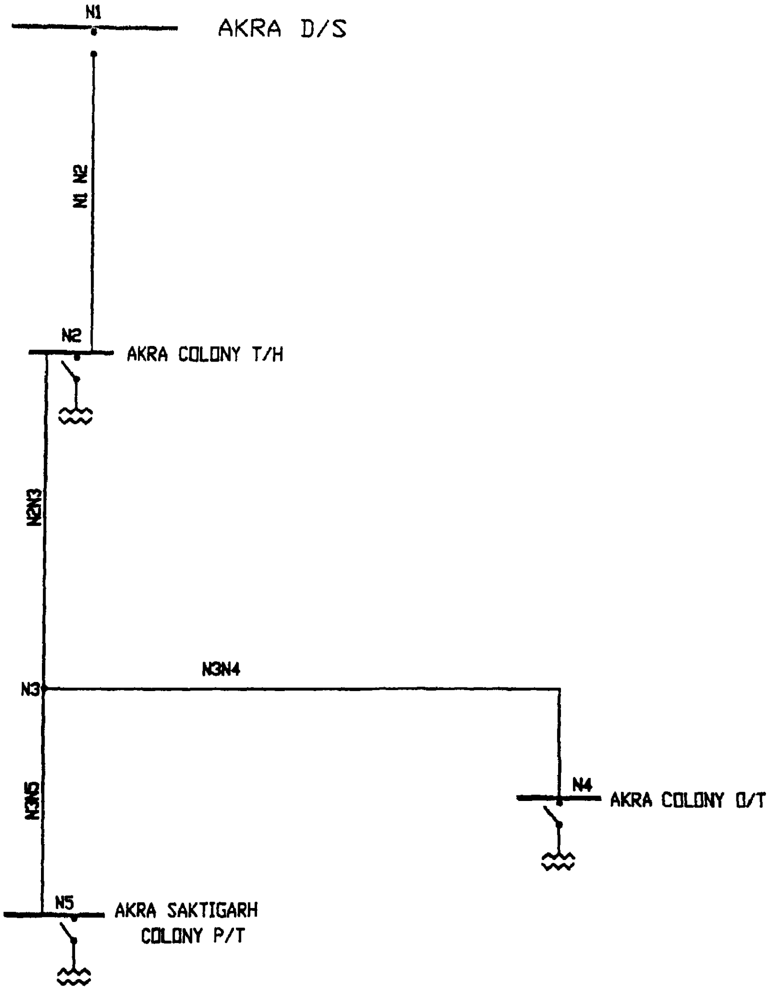
Single Line Diagram of 6 kV Feeders

6 KV FEEDER:- JADAVPORE D/S - L/C AT GANGULY BAGAN T/H



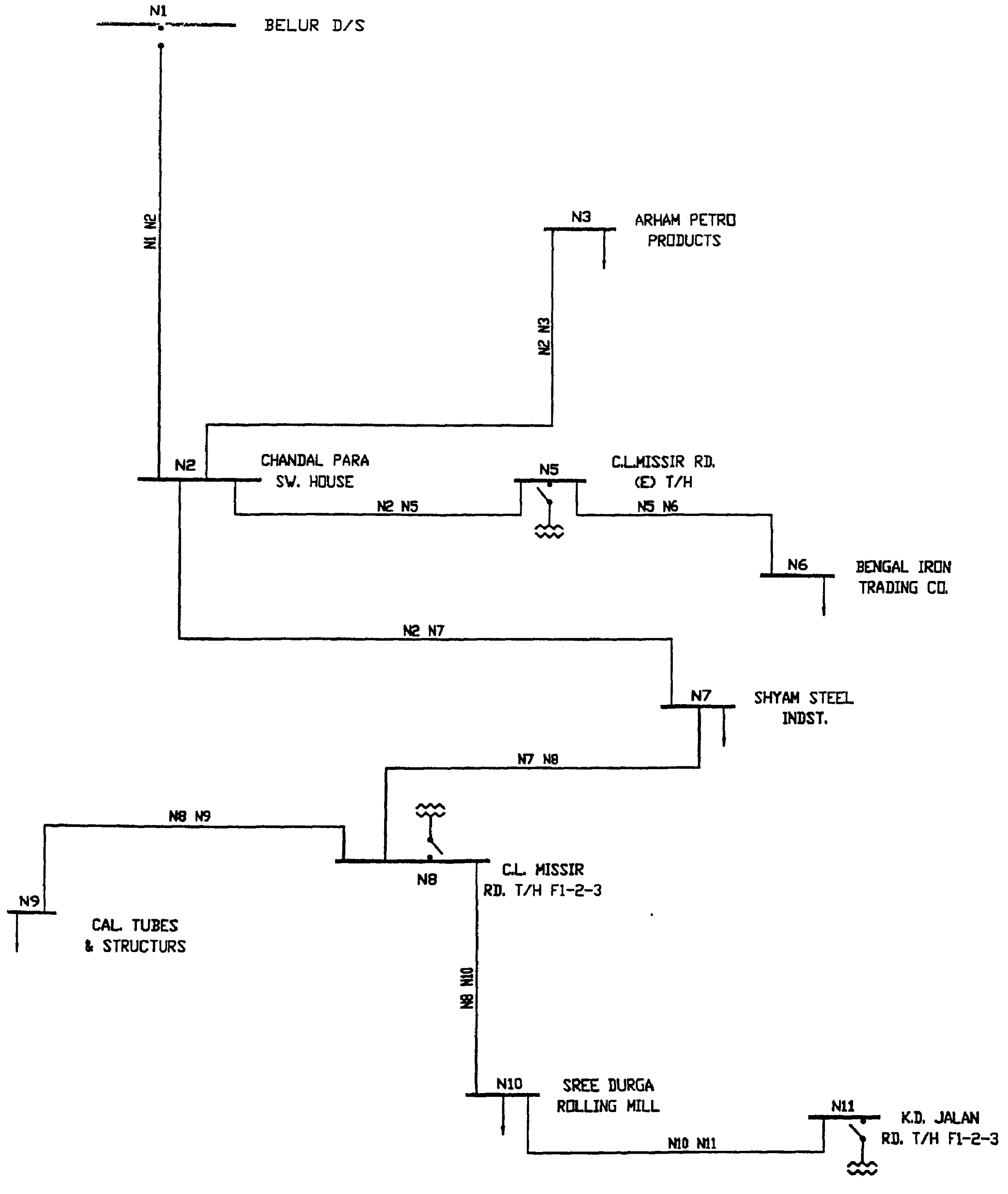
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- AKRA D/S - AKRA COLONY T/H



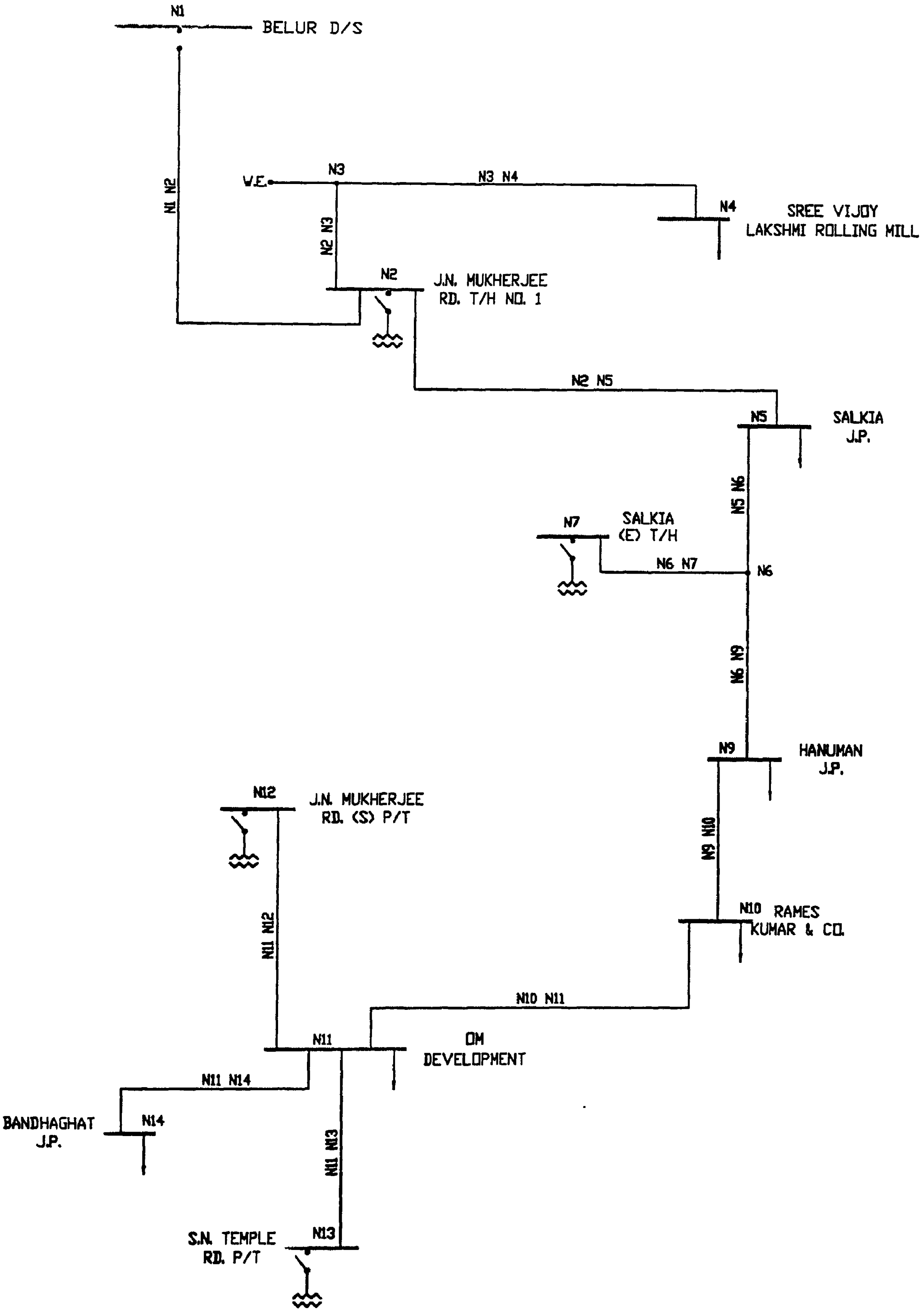
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- BELUR D/S - CHANDALPARA S/H1/SREE HANUMAN J.M.



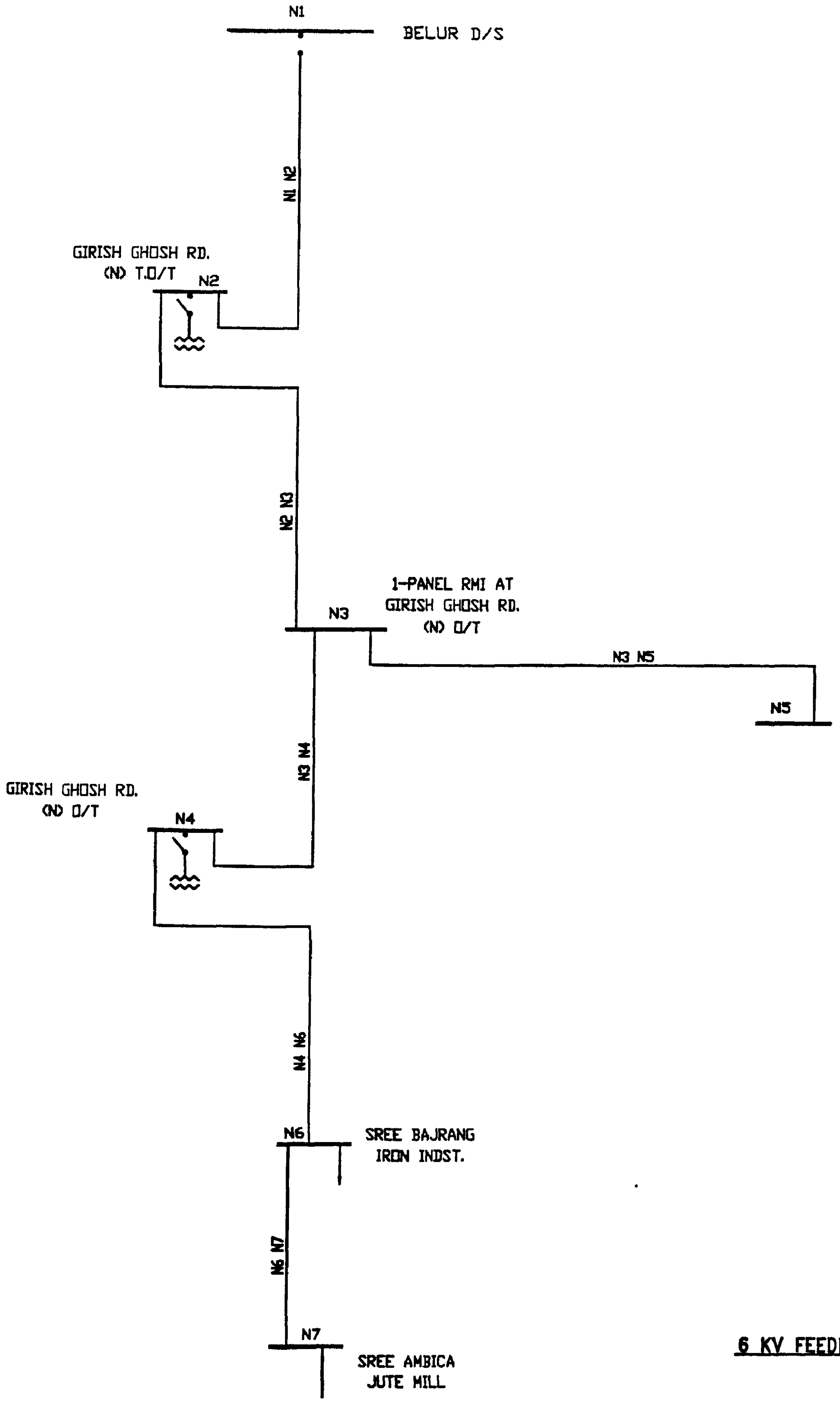
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- BELUR D/S - J.N. MUKHERJEE RD. T/H. NO.1.



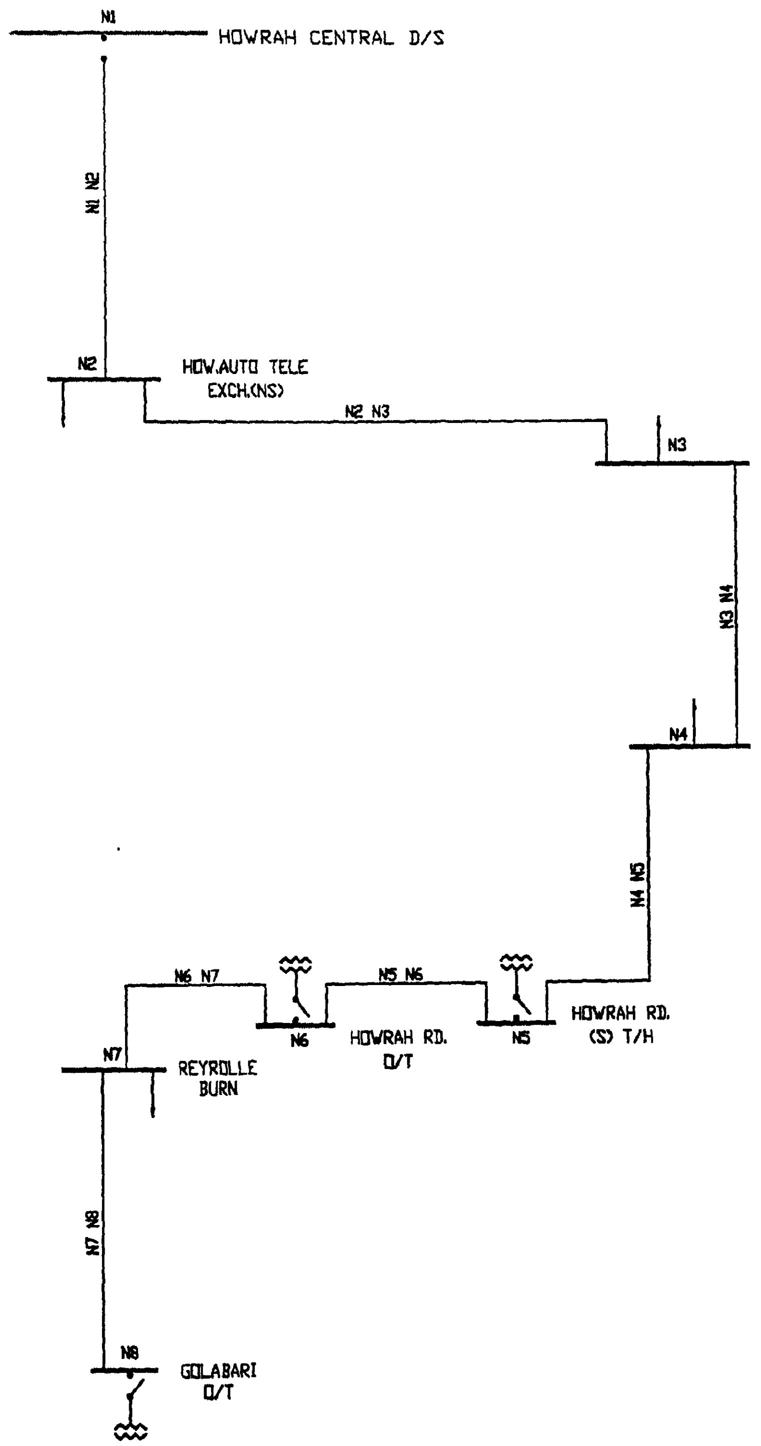
6 KV FEEDER ARRAGEMENT FOR

6 KV FEEDER:- BELUR D/S - SREE AMBICA J.M./BRITISH INDIA R.M.



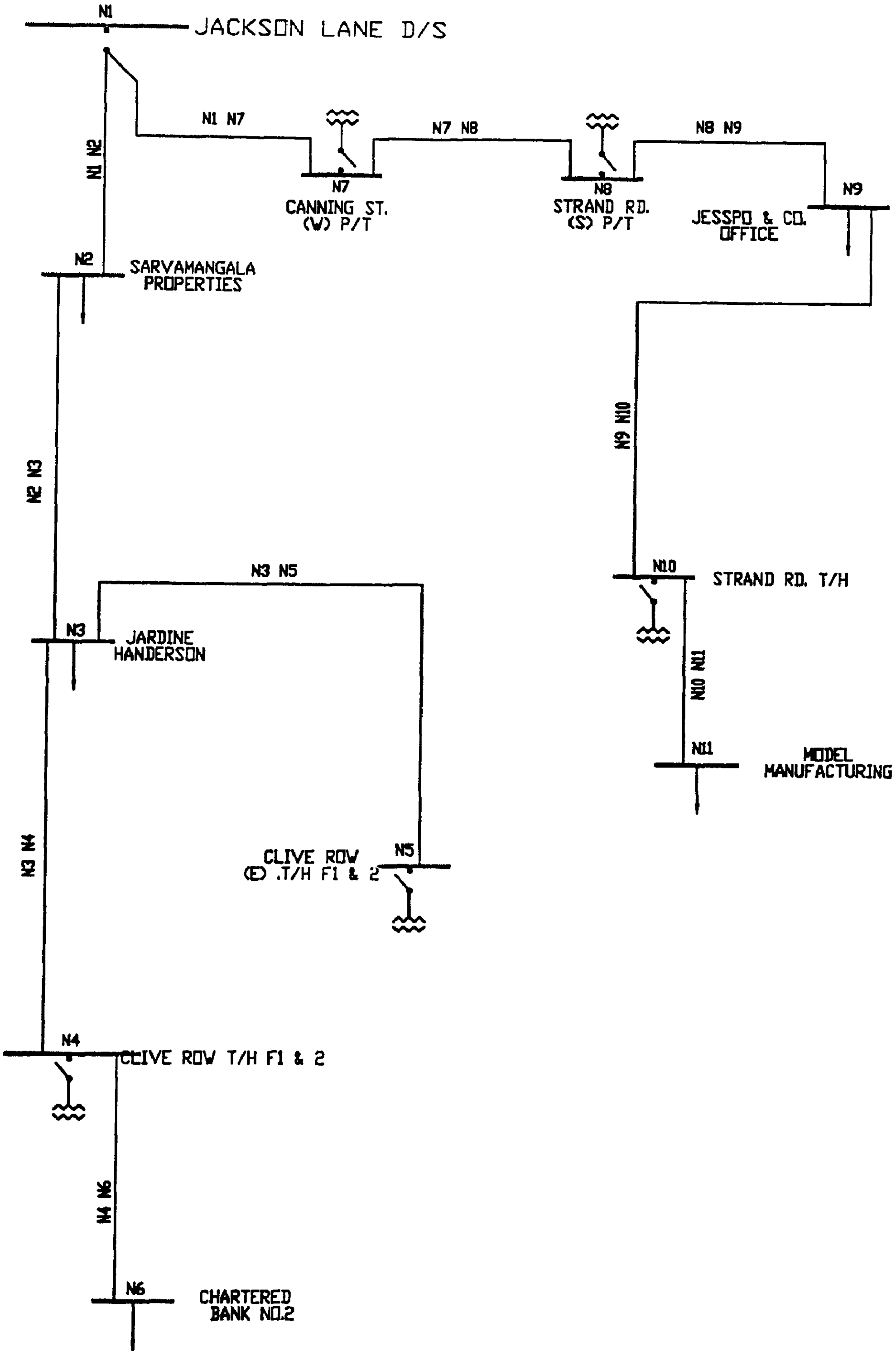
6 KV FEEDER ARRAGEMENT FOR

6 KV FEEDER:- HOWRAH CENTRAL D/S - HOWRAH AUTO TELE EXCH.(NS).



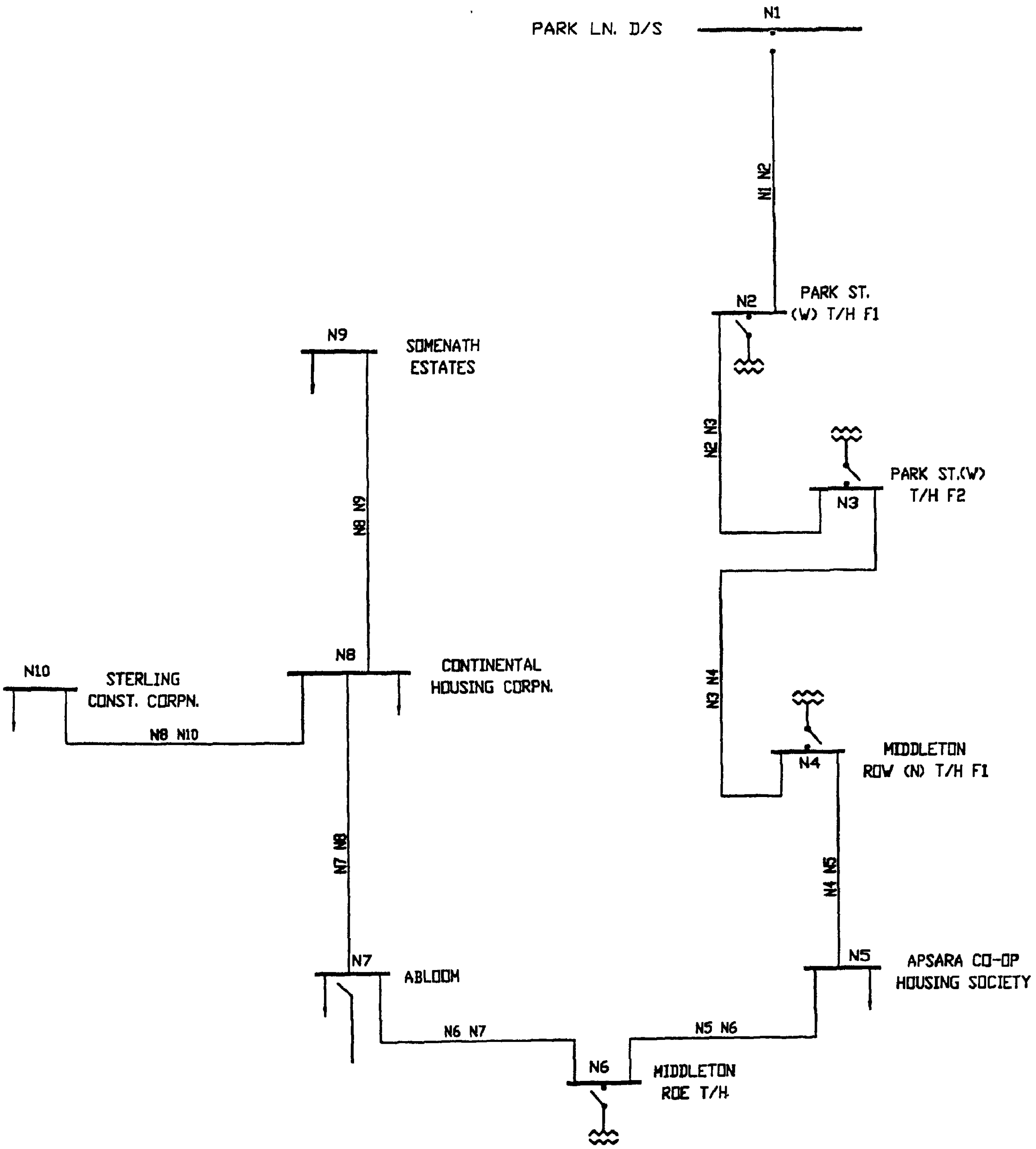
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- JACKSON LN. D/S - SARVAMANGALA PROP/ CANNING ST. (W) P/T



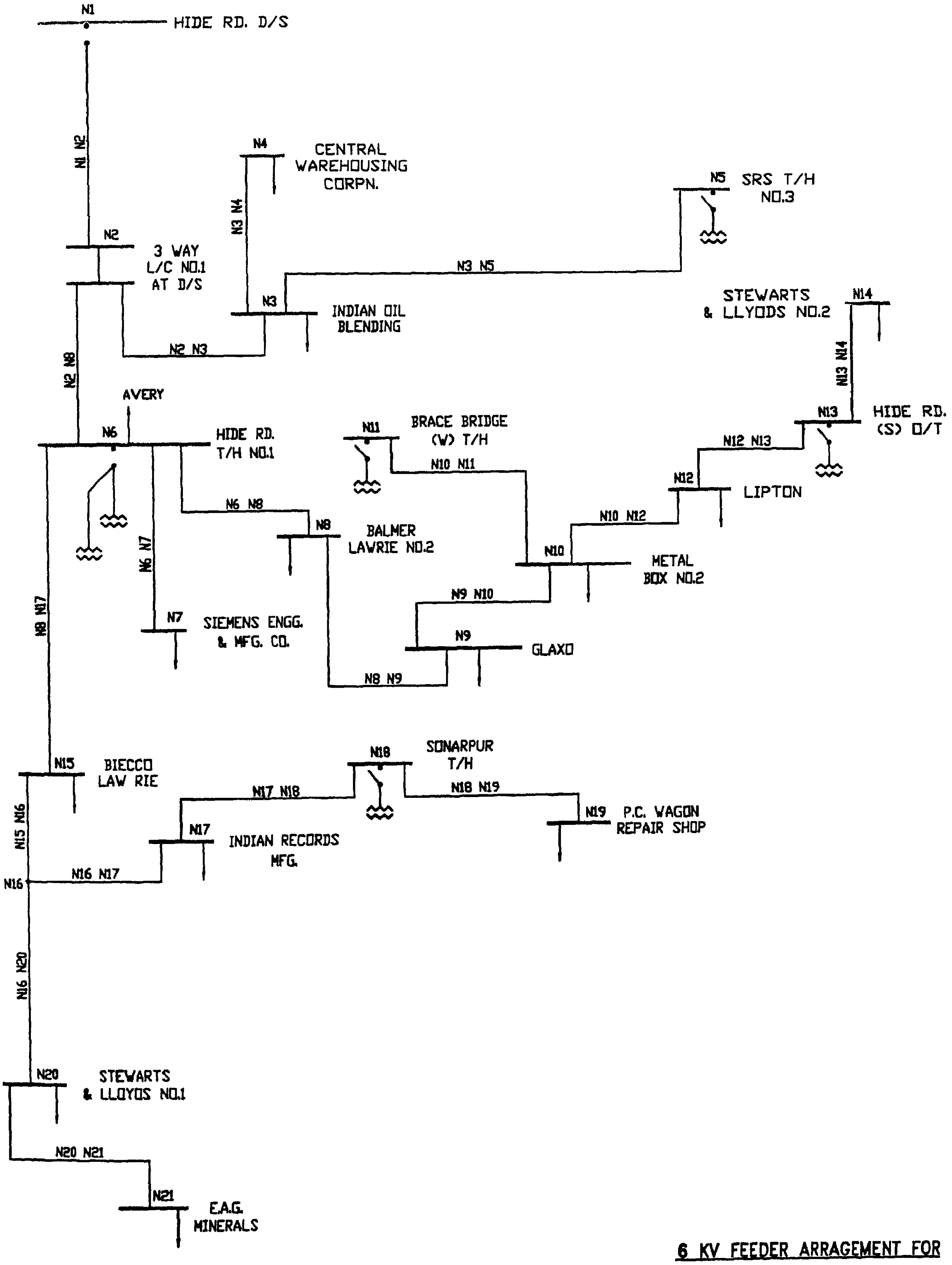
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- PARK LN. D/S - PARK ST. (W) T/H



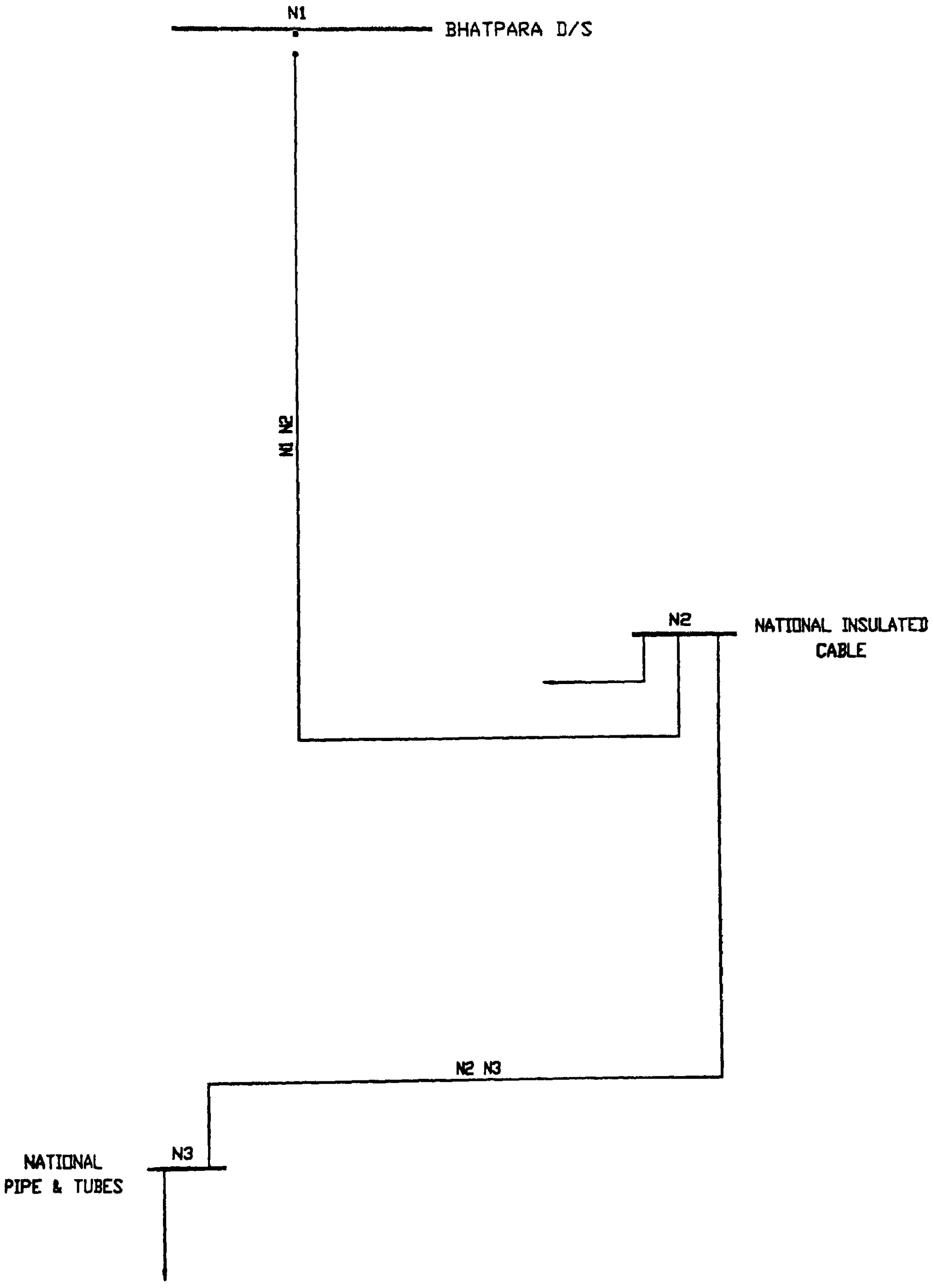
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- HIDE RD. D/S - 3 WAY L/C NO.1 AT D/S



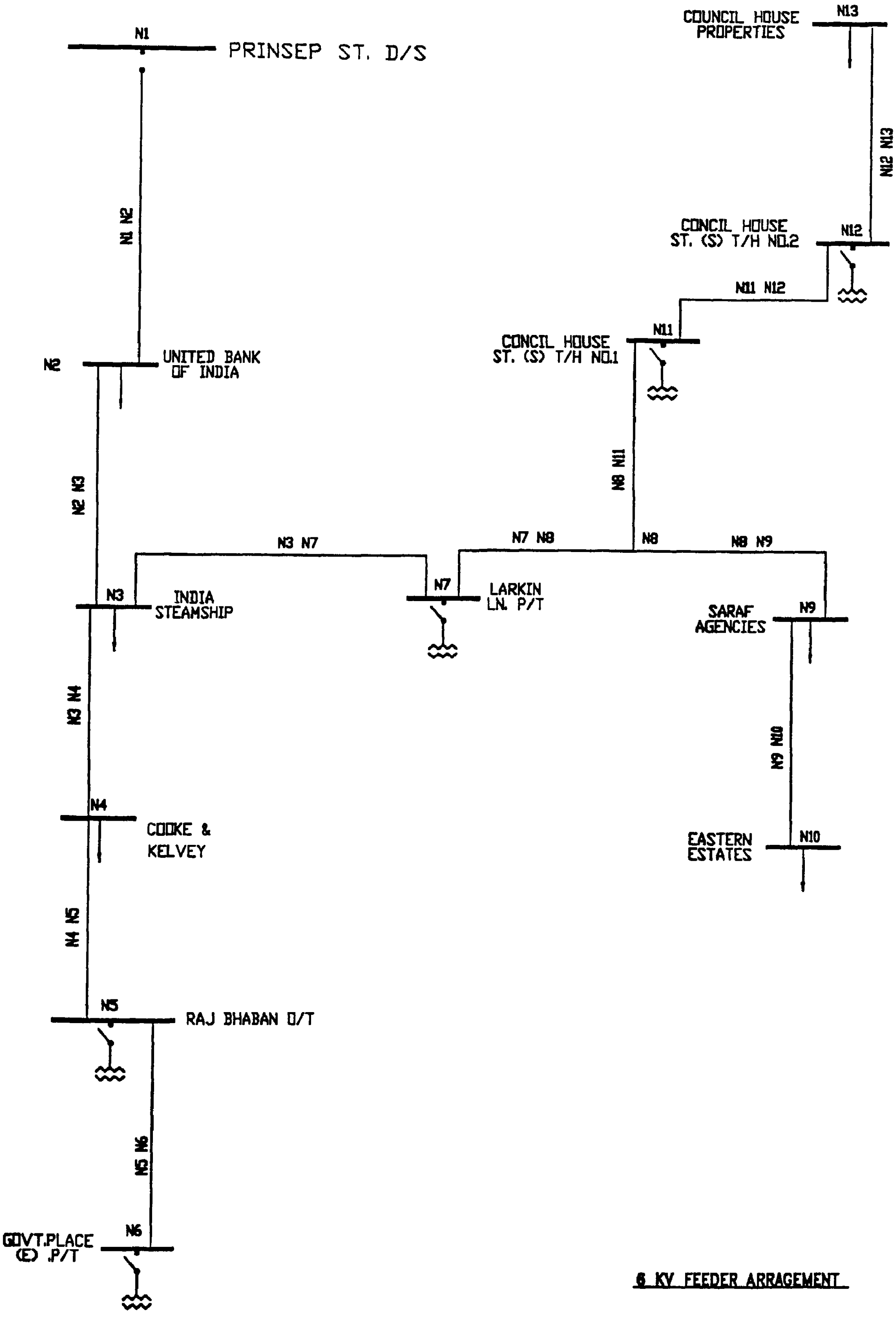
6 KV FEEDER ARRAGEMENT FOR

6 KV FEEDER:- BHATPARA D/S - NATIONAL INSULATED CABLE.



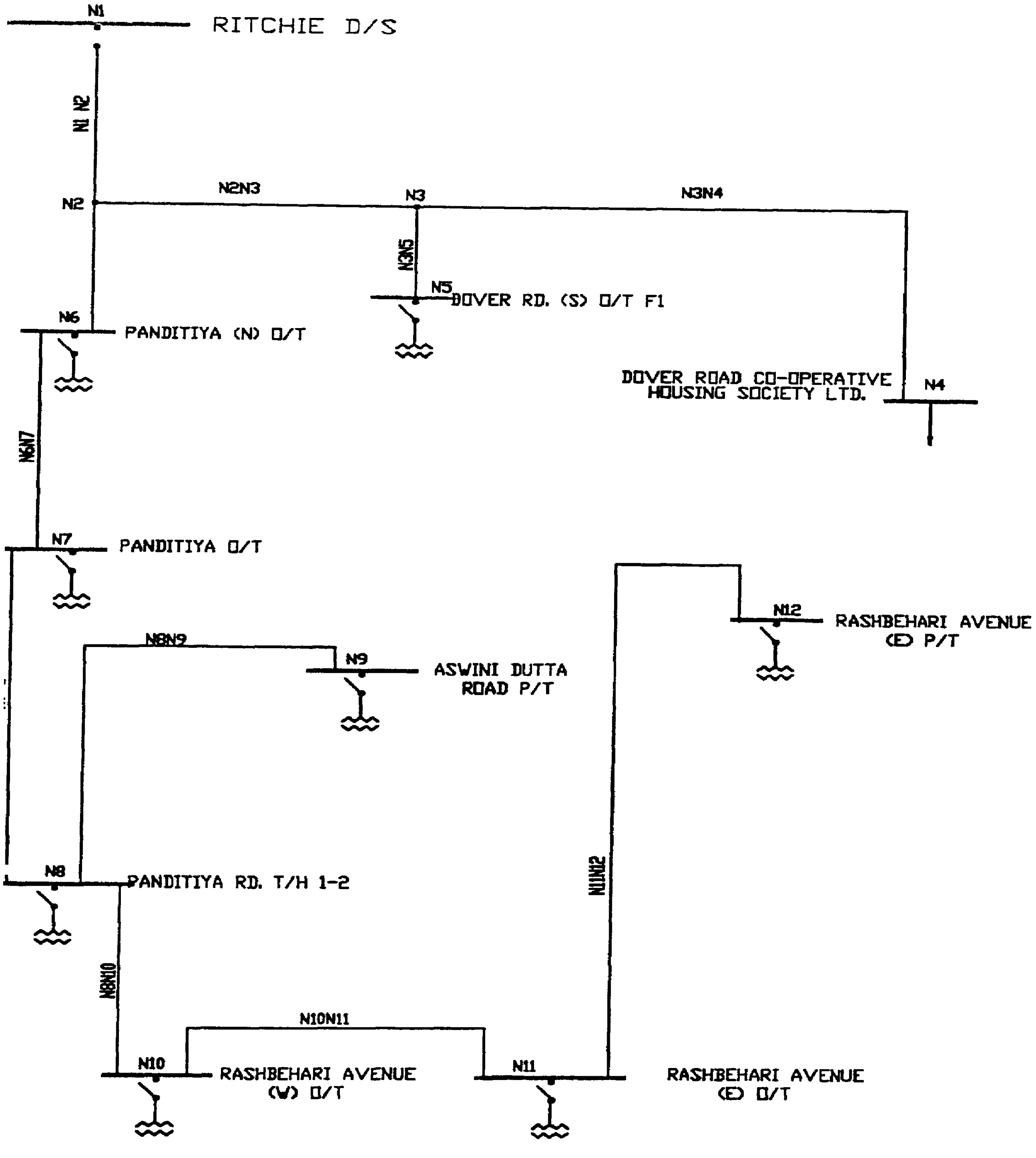
6 KV FEEDER ARRAGEMENT

6 KV FEEDER:- PRINSEP ST. D/S - UNITED BANK OF INDIA F2



6 KV FEEDER ARRAGEMENT

6 KV FEEDER:– RITCHIE D/S – LAKE NORTH T/H

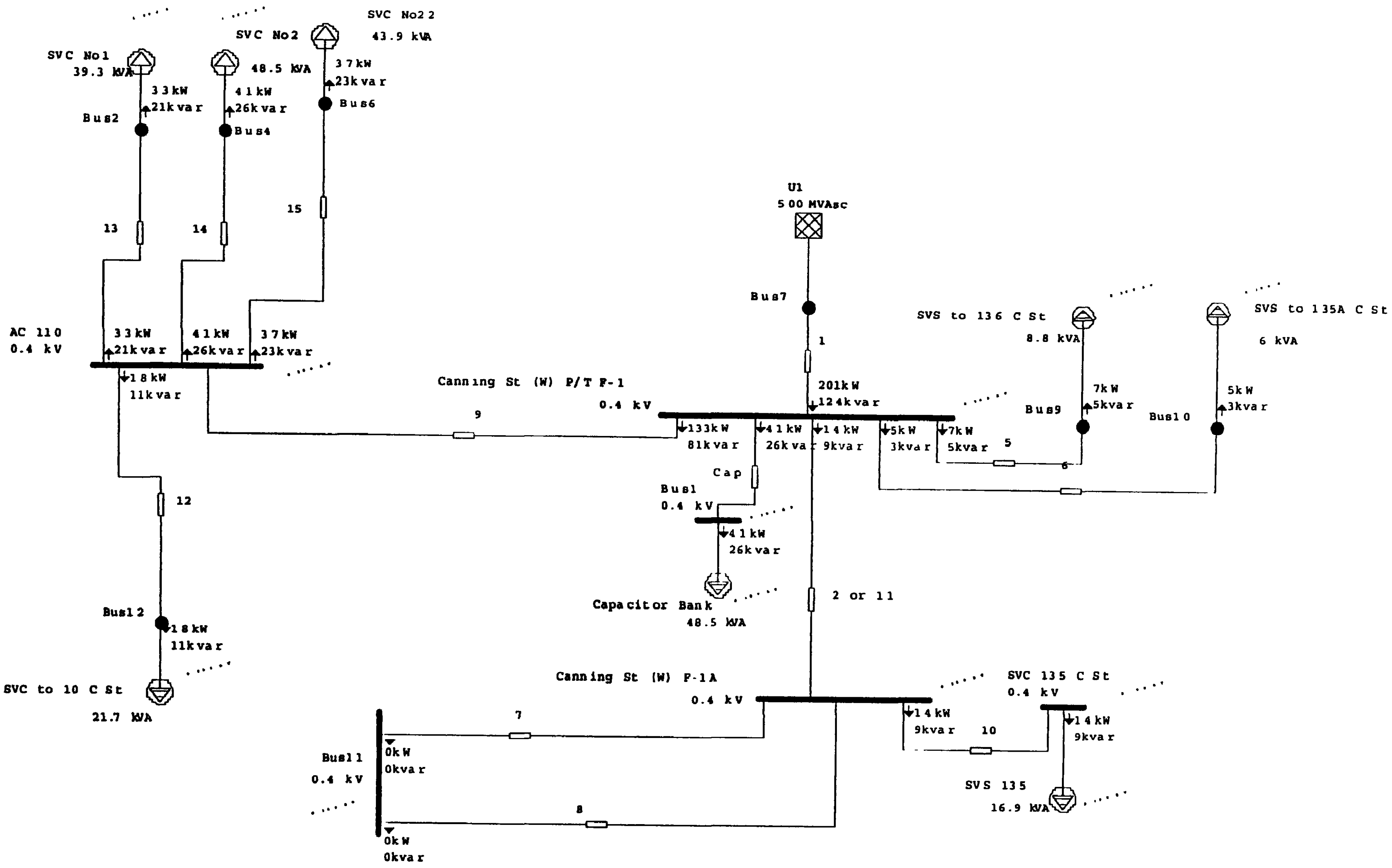


6 KV FEEDER ARRAGEMENT

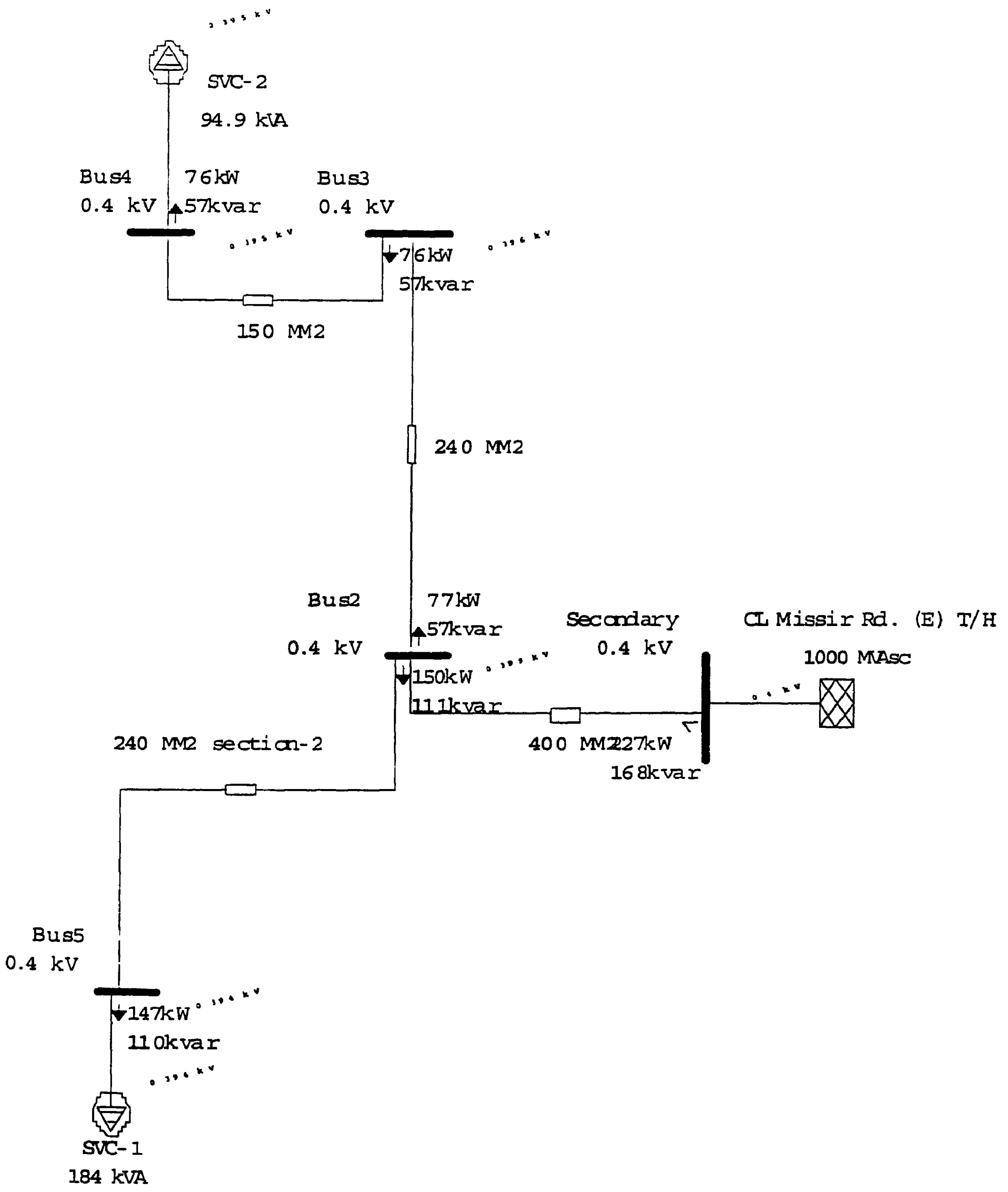
Annex 3

Single Line Diagram of LT Network of Source Transformers

Distribution Transformer: Canning Street (W) P/T



Distribution Transformer: C. L. Missir Road T/H



Annex 4

132 kV Southern Receiving Station Transmission, Load and Transformer's Details

Annex 4.1

Southern receiving station area transmission details

						Circuit Parameters Per Km of Length		
Sl. No.	From Node	To Node	Length	Cross Section	Dielectric Loss (Kw/Km)	R (actual) ohm	X (actual) ohm	Y (actual) mho
	132 Kv							
1	132 WBH1	132SRS2	2.913	161CU	6.60	0.174	0.105	0.000085
2	132WBH2	132SRS5	2.923	161CU	6.60	0.174	0.105	0.000085
3	132WBH3	132SRS7	2.868	161CU	6.60	0.174	0.105	0.000085
4	132SRS1	132MAJ2	6.203	400XLPE	0.87	0.087	0.139	0.000040
5	132SRS8	132MAJ1	6.422	400XLPE	0.87	0.087	0.139	0.000040
	33KV					0.009	0.209	
1	33SRS1	33SOU10	0.094	3003C	1.72	0.137	0.103	0.000147
2	33SRS2	33L/A1	7.816	3003C	1.72	0.137	0.103	0.000147
3	33L/A1	33MTP1	2.488	30003C	1.72	0.137	0.103	0.000147
4	33L/A1	33AUD1	1.382	3003C	1.72	0.137	0.103	0.000147
5	33SRS3	33HRD1	3.327	3003C	1.72	0.137	0.103	0.000147
6	33SRS4	33TARAD1	2.763	3003C	1.72	0.137	0.103	0.000147
7	33SRS6	33ELGD1A	8.773	194CU	0.62	0.140	0.110	0.000119
8	33SRS7	33L/A3	4.729	161CU	0.62	0.144	0.110	0.000101
9	33SRS8	33HRS1	2.703	240GF	0.62	0.189	0.108	0.000129
10	33HRS1	33L/A8	2.438	161CU	0.62	0.144	0.110	0.000101
11	33L/A8	33SHAD1	0.05	300S/C	1.72	0.137	0.103	0.000147
12	33SRS10	33MTP2	10.212	3003C	1.72	0.137	0.103	0.000147
13	33SRS11	33BBGD2	13.309	3003C	1.72	0.137	0.103	0.000147
14	33SRS13	33L/A2	2.946	161CU	0.62	0.144	0.110	0.000101
15	33L/A2	33AKRD1	4.536	3003C	1.72	0.137	0.103	0.000147
16	33SRS15	33SHAD2	4.104	161CU	0.62	0.144	0.110	0.000101
17	33SRS16	33SOUD4	0.659	3003C	1.72	0.137	0.103	0.000147
18	33SRS17	33L/A7	2.931	3003C	1.72	0.137	0.103	0.000147
19	33L/A7	33BBGD1	10.100	OH PANTHER		0.180	0.280	0.000147
20	33SRS19	33SOUD1	0.559	161CU	0.62	0.144	0.110	0.000101
21	33SRS21	33SOUD3	0.423	3003C	1.72	0.137	0.103	0.000147
22	33SRS23	33L/A9	2.85	161CU	0.62	0.144	0.110	0.000101
23	33L/A9	33SHAD3	1.656	161CU	0.062	0.144	0.110	0.000101
24	33L/A9	33GKW3	1.664	161CU	0.062	0.144	0.110	0.000101
25	33HRS3	33HOWWD2	5.12	3003C	1.72	0.137	0.103	0.000147
26	33HRS3	33GKW2	1.664	161CU	0.62	0.144	0.110	0.000101
27	33SRS25	33HOWWD1	8.195	3003C	1.72	0.137	0.103	0.000147
28	33SRS26	33L/A5	4.803	161CU	0.62	0.144	0.110	0.000101
29	33SRS27	33BHOWD1	10.26	3003C	1.72	0.137	0.103	0.000147
30	33SRS28	33TARAD2	2.862	3003C	1.72	0.137	0.103	0.000147
31	33L/A3	33KIDD1	1.5			0.137	0.103	0.000147
32	33KIDD2	33L/A5	1.5			0.137	0.103	0.000147

Annex 4.2

Southern Receiving Station Area Load Details

Sl. No.	Node	Voltage	Power Factor	Active Power MW	Reactive Power MVAR
1	6AL1D1	6.1	0.92	9.1	3.9
2	6HRD1	6.1	0.88	8.5	4.6
3	6TARAD1	6.1	0.87	9.6	3.4
4	6TARAD2	6.1	0.87	9.2	5.2
5	6ELGD1	6.1	0.88	12.5	6.7
6	6KIDD1	6.1	0.90	12.5	5.3
7	6KIDD2	6.1	0.92	11.9	5.1
8	6AKRD1	6.1	0.90	9.8	4.7
9	6BBGD1	6.1	0.90	12.8	6.2
10	6BBGD2	6.1	0.88	5.1	2.8
11	6SOUD1	6.2	0.92	9	3.8
12	6SOUD3	6.2	0.92	8	3.4
13	6SOUD4	6.2	0.92	14.60	6.20
14	6SHAD1	6.1	0.88	9.5	5.1
15	6SHAD2	6.1	0.91	11.9	5.4
16	6SHAD3	6.1	0.91	12.50	5.70
17	6BHOWD1	6.1	0.87	6.00	3.40
18	6HOWWD1	6.1	0.88	10.9	5.9
19	6HOWWD2	6.1	0.87	13.5	7.7
20	33MTP1	33	0.90	1.30	0.60
21	33MTP2	33	0.90	1.50	0.70
22	GKW2	33	0.90	1.00	0.50
23	GKW3	33	0.90	1.00	0.50
24	20SOU10		0.90	2	1.0
	Generation/import Flows				
25	132MAJ2	130	0.95	26.70	-8.80
26	132MAJ1	125	0.95	26.70	-8.80
27	GEN	33	0.94	47.00	17.00

Annex 4.3

Southern Receiving Station Area Transformer Details

Sl. No.	From Node	To Node	Rating MVA	Iron Loss Kw	% Z (Impedence)	X/R Ratio
1	132SRS3	33SRS5	55	57.0	11.21	23.2
2	132SRS4	33SRS9	55	56.4	11.21	23.2
3	132SRS6	33SRS22	55	56.4	11.2	22.6
4	33SOU10	20SOU10	10	22.0	9.54	10.7
5	33ALID1	6ALID1	16	10.0	12.21	21.8
6	33HRD1	6HRD1	16	10.0	12.21	21.8
7	33TARAD1	6TARAD1	16	10.0	12.21	21.8
8	33TARAD2	6TARAD2	16	10.0	12.21	21.8
9	33ELGD1	6ELGD1	16	10.0	12.21	21.8
10	33ELGD2	6ELGD2	16	10.0	12.21	21.8
11	33L/A3	6KIDD1	16	10.0	12.21	21.8
12	33L/A5	6KIDD2	16	10.0	12.21	21.8
13	33AKRD1	6AKRD1	16	10.0	12.21	21.8
14	33BBGD1	6BBGD1	15	25.0	11.42	18.1
15	33BBGD2	6BBGD2	16	10.0	12.21	21.8
16	33SOUD1	6SOUD1	16	10.0	12.21	21.8
17	33SOUD3	6SOUD3	15	25.0	11.42	18.1
18	33SOUD4	6SOUD4	16	10.0	12.21	21.8
19	33SHAD1	6SHAD1	15	25.0	11.42	18.1
20	33SHAD2	6SHAD2	15	25.0	11.42	18.1
21	33SHAD3	6SHAD3	15	25.0	11.42	18.1
22	33BHOWD1	6BHOWD1	16	10.0	12.21	21.8
23	33HOWWD1	6HOWWD1	16	10.0	12.21	21.8
24	33HOWWD2	6HOWWD2	16	10.0	12.21	21.8

Annex 5

132 kV Belur Receiving Station Transmission, Load and Transformer's Details

Annex 5.1

Belur Receiving Station Area Load Details

Sl. No.	Node	Voltage	Ampere	Power Factor	Active Power MW	Reactive Power MVAR
1	6HND1	6.1	866	0.9	8.20	4.00
2	6FSD1	6.1	920	0.9	8.70	4.20
3	6FSD2	6.1	974	0.9	9.30	4.50
4	6BELD2	6.1	757	0.91	7.30	3.30
5	6BELD3	6.1	595	0.91	5.70	2.60
6	6BELD4	6.1	730	0.91	7.00	3.20
7	6LILD1	6.1	687	0.9	6.50	3.20
8	6LILD2	6.1	568	0.92	5.50	2.40
9	6BALD2	6.1	1434	0.92	13.90	5.90
10	6HCEND1	6.2	931	0.9	9.00	4.40
11	6HCEND2	6.2	905	0.9	8.70	4.20
12	33IND1	31.4	121	0.9	5.90	2.90
					95.70	*44.80*
	Generation/import Flows					
13	33NCG1	31.4	120	0.9	5.90	2.80

Annex 5.2

Belur Receiving Station Area Transmission Details

	From Node	To Node	Length	Cross Section	Dielectric Loss (Kw/Km)	R (actual) ohm	X (actual) ohm	Y (actual) mho
	132 Kv							
1	132WBL1	132BRS1	4.46	161CU	6.60	0.180	0.098	0.000085
2	132WBL2	132BRS2	4.437	161CU	6.60	0.180	0.098	0.000085
3	132WBL3	132BRS3	4.385	161CU	6.60	0.180	0.098	0.000085
1	33BRS1	33HND1	2.908	3003C	1.72	0.137	0.103	0.000149
2	33BRS1	33FSD1	17.772	161CU	0.62	0.144	0.110	0.000100
3	33BRS2	33IND1	1.625	3003C	1.72	0.137	0.103	0.000149
4	33BRS3	33NCG1	2.301	161CU	0.62	0.144	0.110	0.000100
5	33BRS3	33NCG1	2.147	161CU	0.62	0.144	0.110	0.000100
6	33BRS6	33FSD2	17.734	161CU	0.62	0.144	0.110	0.000100
7	33BRS8	33BALD2	3.621	161CU	0.62	0.144	0.110	0.000100
8	33BRS9	33HCEND2	5.069	3003C	1.72	0.137	0.103	0.000149
9	33BRS9	33LILD2	2.218	3003C	1.72	0.137	0.103	0.000149
10	33BRS13	33HCEND1	5.165	161CU	0.62	0.144	0.110	0.000100
11	33BRS14	33LILD1	2.236	3003C	1.72	0.137	0.103	0.000149
12	33BRS17	33IND2	1.643	3003C	1.72	0.137	0.103	0.000149

Annex 5.3

Belur Receiving Station Area Transformer Details

Sl. No.	From Node	To Node	Rating MVA	Iron Loss Kw	% Z (Impedance)	X/R Ratio
1	132BRS1	33BRS4	50	51.0	16.61	27.7
2	132BRS2	33BRS12	50	44.0	16.61	27.7
3	132BRS3	33BRS15	50	44.0	16.61	27.7
4	33HND1	6HND1	16	10.0	16.61	29.6
5	33FSD1	6FSD1	12.5	20.5	16.62	23.3
6	33FSD2	6FSD2	12.5	20.5	16.62	23.3
7	33BELD2	6BELD2	20	13.0	16.61	31.9
8	33BELD3	6BELD3	20	13.0	16.61	31.9
9	33BELD4	6BELD4	20	13.0	16.61	31.9
10	33ULD1	6ULD1	16	10.0	12.2	21.8
11	33ULD2	6ULD2	16	10.0	12.2	21.8
12	33BALD2	6BALD2	16	10.0	12.2	21.8
13	33HCEND1	6HCEND1	16	10.0	12.2	21.8
14	33HCEND2	6HCEND2	16	10.0	12.2	21.8

Annex 6

132 kV Park Lane Station Transmission, Load and Transformer's Details

Park Lane Area transmission Details

Sl. No.	From Node	To Node	Length	Cross Section	Dielectric Loss (Kw/Km)	Circuit Parameters Per Km of Length R (actual) ohm	X (actual) ohm	Y (actual) mho
1	33PLN3	33PLND2	0.14	500XLPE	.35	0.090	0.100	0.000094
2	33PLN4	33PCIRD1	1.903	3003C	1.72	0.137	0.103	0.000149
3	33PLN6	33ASQD1	1.367	300XLPE	0.31	0.133	0.120	0.000072
4	33PLN7	33PCIRD2	0.14	500XLPE	.35	0.090	0.100	0.000094
5	33PLN9	33ASQD2	1.332	300XLPE	0.31	0.133	0.120	0.000072
6	33PLN10	33MARD1	1.019	3003C	1.72	0.137	0.103	0.000149

Park Lane Area Load Details

Sl. No.	Node	Voltage	Ampere	Power Factor	Active Power MW	Reactive Power MVAR
1	6PLND1	6.1	1020	0.88	9.50	5.10
2	6PLND2	6.1	1060	0.88	9.90	5.30
3	6ASQD1	6.1	665	0.90	6.30	3.10
4	6ASQD2	6.1	640	0.90	6.10	2.90
5	6PCIRD1	6.1	1070	0.88	9.90	5.40
6	6MARD1	6.1	1050	0.88	9.80	5.30
					51.50	*27.10*
	Generation/import Flows					
7	132MAJ1	125	360	0.89	69.40	35.50
8	132PRS2	125	85	0.92	-16.90	-7.20

Annex 6.3

Park Lane Area Transformer Details

Sl. No.	From Node	To Node	Rating MVA	Iron Loss Kw	% Z (Impedance)	X/R Ratio
1	132PLN2	33PLN5	75	36.0	16.60	44.30
2	132PLN3	33PLN8	75	36.0	16.60	44.30
3	33PLND2	6PLN2	16	10.0	12.20	21.80
4	33PLND1	6PLN1	16	10.0	12.20	21.80
5	33ASQD1	6ASQD1	20	13.0	12.20	23.50
6	33ASQD2	6ASQD2	20	13.0	12.20	23.50
7	33PCIRD1	6PCIRD1	16	10.0	12.20	21.80
8	33MARD1	6MARD1	15	10.0	11.40	19.00

Annex 7

Load and Parameter Details of 6 kV Feeders

Annex 7.1

6 kV Feeders HT consumer's load details

Sl.No	6 KV FEEDER	Name of HT Consumers	Max. Load (Kw)	P.F
1	6kV Feeder - Howrah Cen. D/S - Howrah Auto Tele Exch (NS)	How.Auto.Tele Exch.(NS)	51.6	0.89
		Eastern Rly. Kings Rd.	800	0.93
		Reyrolle Burn	117.8	0.84
2	6kV Feeder - Ritchie D/S - Lake North T/H	Dover Road Co-op. Housing Society Ltd.	28.6	0.99
3	6kV Feeder - Prinsep Street - United Bank of India F2	United Bank of India	1313.6	0.91
		India Streamship	471.2	0.78
		Cooke & Kelvey	102.4	0.75
		Eastern Estates	184.2	0.81
		Saraf Agencies	377.8	0.78
		Council House Properties	197.2	0.78
4	6kV Feeder - Bhatpara D/S - National Insulated Cable	National Insulated Cable	1320	0.94
		National Pipe & Tubes	337.6	0.92
5	6kV Feeder - Belur D/S - Chandalpara S/H1/ Sree Hanuman J.M.	Arham Petro Products	151.6	0.95
		Bengal Iron Trading Co.	347.8	0.93
		Shyam Steel Indst.	1133.6	0.78
		Cal Tubes & Structures	538.8	0.99
		Sree Durga Rolling Mill	462.8	0.81
6	6kV Feeder - Belur D/S - J.N. Mukherjee Road T/H No.1	Sree Vijoy Lakshmi R.M.	371.4	0.93
		Salkia J.P.	66.8	0.65
		Hanuman J.P.	259.6	0.89
		Rames Kumar & Co.	26.2	0.6
		OM Development	660.8	0.95
		Bandhaghat J.P.	63.4	0.66
9	6kV Feeder - Park Lane D/S - Park Street (W) T/H	Somenath Estates	502.4	0.86
		Sterling Const. Corpn.	132.6	0.78
		Apsara Cooperative Housing Society	149.2	0.99
		Continental Housing Coppn.	126	0.87
		Abloom	331.8	0.84
10	6kV Feeder - Belur D/S - Sree Ambica J.M. / British India R.M.	Sree Ambica Jute Mill	1683.6	0.97
		Sree Bajrang Iron Indst.	356	0.98
11	6kV Feeder - Hide Road D/S - 3 Way L/C No.1 at D/S	Central Warehousing Corpn.	24.2	0.71
		Indian Oil Blending	423.6	0.91
		Siemens Engg. & Mfg.Co.	6.8	0.82
		Indian Records Mfg.	103.2	0.91
		BIECCO Lawrie	341.8	0.96
		Stewarts & Lloyds No.1	67	0.78
		P.C. Wagon Repair Shop	153.8	0.98
		Glaxo	69	0.7
		Lipton	13.4	0.73
		Balmer Lawrie No.2	449.6	0.87

		Avery	84.6	0.95
12	6kV Feeder - Jackson Lane D/S - Sarvamangala Prop./ Canning St. (W) P/T	Sarvamangala Properties	166.4	0.98
		Jessop & Co Office	16.4	0.64
		Model Manufacturing	213.6	0.96
		Jardine Handerson	142.2	0.75
		Chartered Bank No.2	115	0.78

Annex 7.2

Load figures & Parameters of Distribution transformers

S. No.	6 kV Feeder	Name of Source	Rating (KVA)	P.F	Load (Amp) at 400 V	Iron Loss (Watts)	% Z (Impedence)
1	Howrah Cen. D/S Howrah Auto Tele Exch(NS)	Howrah Road O/T	315	0.8	440	650	5%
		Howrah Road (S) T/H	300	0.8	300	650	5%
		Golabari O/T	315	0.8	400	650	5%
2	Ritchie D/S - Lake North T/H	Panditiya (N) O/T	315	0.8	250	650	5%
		Dover Road (S) O/T	315	0.8	340	650	5%
		Panditiya O/T F1	200	0.8	300	650	5%
		Aswini Dutta Road P/T	315	0.8	275	650	5%
		Rashbehari Avenue (E) P/T F1	315	0.8	200	650	5%
		Panditiya Road T/H F1-2	800	0.8	950	1800	5%
		Rashbehari Avenue (E) O/T	300	0.8	200	650	5%
		Rashbehari Avenue (W) O/T	315	0.8	300	650	5%
3	Prinsep Street - United Bank of India F2	Raj Bhaban O/T	315	0.8	90	650	5%
		Govt. Place (E) P/T	315	0.8	290	650	5%
		Larkin Ln. P/T	315	0.8	360	650	5%
		Council House St.(S) T/H No.1	315	0.8	460	650	5%
		Council House St.(S) T/H No.2	315	0.8	250	650	5%
5	Belur D/S - Chandalpara S/H1/ Sree Hanuman JM	C.L. Missir Road (E) T/H	315	0.8	460	650	5%
		C.L. Missir Road T/H 1-3	570	0.8	520	1000	5%
		K.D. Jalan Road T/H 1-3	800	0.8	1100	1800	5%
		K.D. Jalan Road T/H No.2	400	0.8	550	900	5%
6	Belur D/S - J.N. Mukherjee Road T/H No.1	J.N. Mukherjee Rd. T/H No.1	315	0.8	450	650	5%
		Salkia (E) T/H	315	0.8	380	650	5%
		J.N. Mukherjee Rd. (S) P/T	315	0.8	450	650	5%
		S.N. Temple Rd. T/H	315	0.8	350	650	5%
7	Jadavpur D/S - L/C at Ganguly Bagan T/H	Ganguly Bagan O/T	315	0.8	450	650	5%
		Gouranga Mandir T/H	315	0.8	380	650	5%
		Gouranga Mandir O/T	200	0.8	200	450	5%
		Ganguly Bagan T/H	315	0.8	440	650	5%
		Ramgarh O/T	315	0.8	400	650	5%
		Ganguly Bagan P/T	300	0.8	380	650	5%
		Garia T/H	315	0.8	450	650	5%
		Garia (N) O/T	300	0.8	360	650	5%
8	Akra D/S - Akra Colony T/H	Akra Colony T/H	315	0.8	475	650	5%
		Akra Saktigarh Colony P/T	315	0.8	350	650	5%
		Akra Colony O/T	315	0.8	500	650	5%
9	Park Lane D/S - Park St.(W) T/H	Park Street (W) T/H	600	0.8	450	1500	5%
		Park Street (W) T/H No.2	315	0.8	300	650	5%
		Middleton Row (N) T/H	315	0.8	290	650	5%
		Middleton Road T/H	600	0.8	400	1500	5%
		(Note: Camac was not installed)					
10	Belur D/S - Sree Ambica J.M. / British India R.M.	Girish Ghosh Rd. (N) Temp..O/T	400	0.8	300	900	5%
		Girish Ghosh Rd. (N) O/T	315	0.8	400	650	5%

11	Hide Road D/S - 3 Way L/C No.1 at D/S	SRS T/H No.3					
		Hide Road (S) O/T	315	0.8	250	650	5%
		Sonarpur T/H	200	0.8	250	450	5%
		Brace Bridge (W) T/H	200	0.8	100	450	5%
		Hide Road T/H No.1	200	0.8	180	450	5%
		Hide Road T/H No.2	200	0.8	180	450	5%
12	Jackson Ln.D/S - Sarvamangala Prop./Canning Street (W) P/T	Canning St. (W) P/T	315	0.8	500	650	5%
		Strand Road (S) P/T	315	0.8	400	650	5%
		Strand Road T/H	450	0.8	700	900	5%
		Clive Row (E) T/H F1-2	800	0.8	600	1800	5%
		Clive Row T/H F1-2	800	0.8	600	1800	5%

Annex 7.3

6 kV Feeders Line parameters

			Circuit Parameters Per Km of Length		
Sl. No.	From-To Node	Length (m)	R (actual) ohm	X (actual) ohm	Y (actual) mho
Feeder	Lake North T/H				
	N1-N2	323	0.2306	0.0811	0.000172
	N2-N3	113	0.4818	0.0942	0.000111
	N3-N4	60	0.4818	0.0942	0.000111
	N3-N5	65	0.4818	0.0942	0.000111
	N2-N6	200	0.2087	0.0806	0.000175
	N6-N7	138	0.1761	0.0800	0.000181
	N7-N8	375	0.2402	0.0812	0.000170
	N8-N9	179	0.2409	0.0864	0.000141
	N8-N10	373	0.1205	0.0790	0.000189
	N10-N11	313	0.1205	0.0790	0.000189
	N11-N12	171	0.1205	0.0790	0.000188
Feeder	Akra Colony T/H				
	N1-N2	50	0.1205	0.0790	0.000189
	N2-N3	27	0.4818	0.0942	0.000113
	N3-N4	459	0.4818	0.0942	0.000111
	N4-N5	499	0.4799	0.0938	0.000111
Feeder	L/C At Ganguly Bagan T/H				
	N1-N2	2187	0.1662	0.0779	0.000203
	N2-N3	10	0.1205	0.0790	0.000194
	N3-N7	10	0.4818	0.0942	0.000111
	N7-N8	350	0.4818	0.0942	0.000111
	N2-N4	314	0.1205	0.0790	0.000189
	N4-N5	261	0.4021	0.0889	0.000228
	N5-N6	129	0.2359	0.0846	0.000155
	N3-N9	139	0.4995	0.0882	0.000144
	N9-N10	365	0.6894	0.0929	0.000117
	N10-N11	157	0.4375	0.0890	0.000133
Feeder	Howrah Auto Telephone Exchange (NS)				
	N1-N2	30	0.1248	0.0754	0.000231
	N2-N3	731	0.1248	0.0754	0.000231
	N3-N4	383	0.1662	0.0779	0.000203
	N4-N5	129	0.2244	0.0834	0.000161
	N5-N6	498	0.2025	0.0809	0.000180
	N6-N7	138	0.2484	0.0814	0.000169
	N7-N8	149	0.7476	0.0942	0.000112
Feeder	Sarvamangala Prop/Canning St. (W) P/T				
	N1-N2	318	0.2259	0.0847	0.000154
	N2-N3	94	0.7476	0.0942	0.000112
	N3-N4	184	0.7476	0.0942	0.000112
	N4-N6	57	0.7476	0.0942	0.000112
	N3-N5	156	0.2484	0.0814	0.000169
	N1-N7	261	0.2418	0.0858	0.000145
	N7-N8	214	0.2420	0.0857	0.000145
	N8-N9	91	0.2409	0.0864	0.000140
	N9-N10	215	0.2436	0.0846	0.000151
	N10-N11	153	0.2471	0.0823	0.000165
Feeder	National Insulated Cable				
	N1-N2	1555	0.1460	0.0806	0.000177
	N2-N3	299	0.1448	0.0810	0.000172

Feeder	**Sree Ambica J.M./British India R.M.**				
	N1-N2	10	0.1248	0.0754	0.000222
	N2-N3	14	0.1248	0.0754	0.000238
	N3-N4	12	0.1662	0.0779	0.000208
	N3-N5	152	0.2484	0.0814	0.000170
	N4-N6	963	0.2373	0.0856	0.000147
	N6-N7	410	0.2389	0.0862	0.000144
Feeder	**United Bank of India F-2**				
	N1-N2	1218	0.1473	0.0800	0.000182
	N2-N3	78	0.1662	0.0779	0.000203
	N3-N4	42	0.8978	0.1060	0.000079
	N4-N5	184	0.8831	0.1048	0.000083
	N5-N6	196	0.8978	0.1060	0.000081
	N3-N7	52	0.4684	0.0935	0.000112
	N7-N8	144	0.3927	0.0893	0.000133
	N8-N9	9	0.4818	0.0942	0.000123
	N9-N10	100	0.7476	0.0942	0.000111
	N8-N11	54	0.7476	0.0942	0.000113
	N11-N12	34	0.7476	0.0942	0.000114
	N12-N13	80	0.7476	0.0942	0.000111
Feeder	**Park Lane D/S tp Park Street**				
	N1-N2	700	0.1248	0.0754	0.000231
	N2-N3	30	0.1248	0.0754	0.000231
	N3-N4	205	0.1248	0.0754	0.000230
	N4-N5	131	0.1248	0.0754	0.000231
	N5-N6	151	0.1248	0.0754	0.000230
	N6-N7	475	0.1248	0.0754	0.000230
	N7-N8	157	0.1248	0.0754	0.000230
	N8-N9	267	0.1248	0.0754	0.000231
	N8-N10	1016	0.1248	0.0754	0.000230
Feeder	**J. N. Mukherjee Road T/H No.1**				
	N1-N2	1266	0.2313	0.0849	0.000152
	N2-N3	48	0.7476	0.0942	0.000110
	N3-N4	174	0.7476	0.0942	0.000112
	N2-N5	964	0.2380	0.0861	0.000144
	N5-N6	110	0.2409	0.0864	0.000141
	N6-N7	138	0.8456	0.1019	0.000091
	N7-N8	62	0.8203	0.0999	0.000099
	N6-N9	138	0.2409	0.0864	0.000141
	N9-N10	226	0.2085	0.0827	0.000168
	N10-N11	102	0.2409	0.0864	0.001416
	N11-N12	76	0.7476	0.0942	0.000110
	N11-N13	72	0.2484	0.0814	0.000170
	N11-N14	98	0.2409	0.0864	0.000142
Feeder	**Chandalpara S/H1/Sree Hanuman J.M.**				
	N1-N2	1690	0.1454	0.0809	0.000173
	N2-N3	559	0.1248	0.0754	0.000231
	N2-N5	254	0.2484	0.0814	0.000170
	N5-N6	65	0.2484	0.0814	0.000171
	N2-N7	206	0.2322	0.0849	0.000152
	N7-N8	217	0.2422	0.0855	0.000146
	N8-N9	115	0.7476	0.0942	0.000111
	N8-N10	499	0.2409	0.0864	0.000014
	N10-N11	217	0.2414	0.0861	0.000143
Feeder	**3 Way L/C No. 1 at D/S**				
	N1-N2	20	0.1248	0.0754	0.000236
	N2-N3	1731	0.1639	0.0780	0.000202
	N3-N4	30	0.7476	0.0942	0.000111

N3-N5	2068	0.1968	0.0808	0.000180
N2-N6	1572	0.1448	0.0808	0.000174
N6-N7	19	0.7476	0.0942	0.000117
N6-N8	66	0.1662	0.0779	0.000202
N8-N9	92	0.1585	0.0790	0.000193
N9-N10	270	0.2409	0.0864	0.000142
N10-N11	370	0.5189	0.0907	0.000125
N10-N12	168	0.7476	0.0942	0.000111
N12-N13	445	0.7476	0.0942	0.000111
N13-N14	30	0.7476	0.0942	0.000111
N6-N15	115	0.2258	0.0850	0.000152
N15-N16	107	0.1906	0.0807	0.000182
N16-N17	207	0.8586	0.1029	0.000089
N17-N18	340	0.8510	0.1023	0.000090
N18-N19	124	0.8700	0.1038	0.000085
N16-N20	482	0.2377	0.0843	0.000154
N20-N21	343	0.2391	0.0852	0.000149

Annex 8

Load Curve of 132 kV Southern, Belur and Park Lane Station

Annex 8

TIME	PARK LN MW	BELUR MW	SOUTHERN MW
00.00	26	67	97
01.00	23	62	86
02.00	22	60	82
03.00	22	60	80
04.00	21	62	80
05.00	21	64	80
06.00	21	63	80
07.00	21	69	88
08.00	26	83	111
09.00	36	90	124
10.00	49	98	135
11.00	58	95	138
12.00	62	96	136
13.00	61	87	123
14.00	59	92	124
15.00	61	90	129
16.00	60	92	134
17.00	63	100	142
18.00	56	97	154
19.00	53	99	157
20.00	45	88	148
21.00	38	84	135
22.00	35	80	126
23.00	30	76	107
LF	**0.64**	**0.81**	**0.74**
LLF	**0.48**	**0.71**	**0.61**

Annex 9

Load Pattern of 6 kV Feeders

Annex 9

Load Curves of 6kV Feeders

Time	Howrah Auto Tele Exchange	Lake North T/H	United Bank of India F2	National Insulated Cable	Chandara S/H1/Sree Hanuman JM	Mukherjee Road T/H No1	L/C at Ganguly Bagan T/H	Akra Colony T/H	Park St.(W) T/H	Ambica J.M. / British India R.M.	3 Way L/C No.1	Sarvamangala Prop./Canning
	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW
01.00	494	293	155	195	444	555	615	212	483	505	718	107
02.00	494	244	155	195	444	444	522	212	483	505	646	107
03.00	329	244	155	195	444	444	517	159	429	505	646	107
04.00	494	293	155	195	555	444	522	159	429	631	573	107
05.00	659	293	155	195	555	555	517	159	429	631	573	107
06.00	824	293	155	439	666	555	517	212	376	757	573	107
07.00	824	293	258	244	666	555	566	212	429	757	581	179
08.00	824	342	258	586	666	666	586	265	483	757	581	179
09.00	824	390	515	488	888	722	586	302	537	1009	928	358
10.00	824	439	1159	878	1221	777	586	302	590	1388	1009	805
11.00	824	488	1417	293	1221	888	551	284	698	1388	1194	927
12.00	741	488	1546	293	1110	777	576	297	752	1262	1178	976
13.00	659	537	1546	293	1110	777	634	327	752	1262	952	976
14.00	659	586	1546	293	999	777	600	309	752	1135	872	976
15.00	659	634	1546	293	1221	777	595	307	752	1388	1025	976
16.00	659	683	1546	488	1221	888	610	314	805	1388	1009	976
17.00	659	732	1417	390	1332	833	693	357	966	1514	1041	927
18.00	824	732	1095	390	1332	944	800	412	1020	1514	952	760
19.00	824	683	773	342	999	888	927	478	913	1135	1247	537
20.00	824	634	580	488	888	888	908	468	805	1009	1193	403
21.00	824	537	386	342	777	833	869	447	698	883	1179	268
22.00	741	488	322	195	888	722	854	440	644	1009	1118	224
23.00	576	439	258	244	777	722	752	371	537	883	983	179
24.00	412	390		244	555	722	717	318	483	631	786	89
							#REFI					
LF	0.83	0.64	0.48	0.39	0.66	0.76	0.70	0.64	0.62	0.66	0.72	0.48
LLF	0.74	0.47	0.31	0.22	0.50	0.63	0.56	0.48	0.46	0.50	0.58	0.31

Annex 10

Energy Flow Details of 132 kV Selected Network

ENERGY FLOWS

Southern System

						28.06.2001		28.07.2001							
	Metering Point	Location	Identification	MF		First Reading		SECOND Reading		Meter Advance		Energy handeled		Net Energy Flow	
				Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Imp-Exp	
	Feed from WBSEB														
a	132WBL1	WBSEB													
b	132WBL2	WBSEB													
c	132WBL3	WBSEB		4.0	4.0	300412		304864		4452		17806			
A	Units Imported from WBSEB Howrah (a+b+c)													17806.3	
d	132SRS2	SRS	WBSEB1	10.0	10.0	122432	482	122991	506	559	24	5590	240	5350	
e	132SRS5	SRS	WBSEB2	10.0	10.0	127586	486	128162	507	576	21	5760	210	5550	
f	132SRS7	SRS	WBSEB3	10.0	10.0	136350	378	136978	389	628	11	6280	110	6170	
												17630	560		
B	Net Units Imported from WBSEB at SRS 132 kV Busbar Import(d+e+f)-Export(d+e+f)													17630	
C	Units Loss in 132 kV Circuits between WBSEB Howrah & SRS													176	
	Percentage Loss													0.99	
	Feed from Majerhat 132 kv														
g	132MAJ1	Majerhat	SRS1	1.0	1.0	969198	192159	971379	203019	2181	10860	2181	10860	8679	
h	132MAJ2	Majerhat	SRS2	1.0	1.0	64728	59340	66089	69294	1361	9954	1361	9954	8593	
														17366	Note 1
i	132SRS1	SRS	MAJ1 (import)	1.0	1.0	42065	24741	51934	26133	9869	1392	9869	1392	8477	
j	132SRS8	SRS	MAJ2 (import)	1.0	1.0	52793	23490	63446	25275	10653	1785	10653	1785	8868	
D	Net Units Imported from Majerhat 132 kV System at SRS 132 kV Busbar Import(i+j)-Export(i+j)													17345	
E	Units Loss in 132 kV Circuits between SRS and Majerhat													20	Note 2
F	Input to Southern 132 KV Bus (B+D)													34975	
	Feed to 33 KV Bus from 132 kV Bus at SRS														
n	33SRS5	SRS (SBB)	T1 (33 KV Side)	5.0	5.0	221	24513	225	26826	4	2313	20	11565	-11545	
o	33SRS9	SRS (SBB)	T2 (33 KV Side)	5.0	5.0	224	24287	224	26505	0	2218	0	11090	-11090	
p	33SRS22	SRS (DBB)	T3 (33 KV Side)	5.0	5.0	1052	23222	1160	25657	108	2435	540	12175	-11635	
														-34270	
G	Units Loss in 132 /33 kV Transformation at SRS													705	

	Percentage Loss													**2.02**
Generation at 33 KV Southern Bus														
q	33SRS18	SRS (DBB)	GT1	10.0	10 0	326226		329585		3359	0	33590	0	33590
r	33SRS24	SRS (DBB)	GT2	10 0	10 0	333080		336807		3727	0	37270	0	37270
H	**Units input to 33 kV Bus From Generation (q+r)**													**70860**
I	**Total Units Input at Southern 33 KV Bus (G+H)**													**105130**
Energy Export to the other 33 KV Systems														
s	33SRS1	SRS	MAJ1 (outdoor ckt dividing)	75.0	75.0	4910	770	4910	770	0	0	15	-1	16
t	33SRS3	SRS	MAJ2 (outdoor ckt dividing)	15.0	15 0	4341	3476	4342	3476	1	0	10	0	10
u	33SRS6	SRS	MAJ3 (outdoor ckt dividing)	15.0	15 0	5210	538	5210	838	0	300	0	4500	-4500
v	33SRS12	SRS (SBB)	PRS2	7.5	7 5		2364		2909	0	545	0	4088	-4088
w	33SRS8	SRS (SBB)	GKW 1/Shalimar 1	7 5	7 5		1778		2422	0	644	0	4830	-4830
x	33SRS20	SRS (DBB)	Ckt Div 2 at HRS (J) BAU2	3 0	1	21840	192095	21941	193141	101	1046	101	3138	-3037
y														
J	**Units Exported to System at 33 kV (s+t+u+v+w+x)**													**-16428**

Energy Consumed at Station Auxilliaries														
z	ST (33/6KV)	SRS (DBB)	T1	1 0	1 0	147644		149275		1631	0	1631	0	1631
aa	ST (33/6KV)	SRS (DBB)	T2	1 5	1.5	37051		38061		1010	0	1515	0	1515
ab	ET1	SRS	T1	0.004	0 004	40389		47343		6954	0	28	0	28
ac	ET2	SRS	T2	0.004	0 004	162850		162850		0	0	0	0	0
K	**Total Units consumed in Station Auxilliaries (z+aa+ab+ac)**													**3174**
L	**Balance Units at 33 kV Bus for feeding Load Points (I-s-J-K)**													**85529**
Load Points														
	20SOU10	Southern 20kV		15.0		9237		9312		76		1133		1133
	6ALID1	Alipore T1		16 0		15483		15687		205		3274		3274
	6HRD1	Hide Rd.		16 0		4210		4452		242		3875		3875
	6AKRD1	Akra(6kV)		16.0		7615		7801		186		2976		2976
	11AKRD1	Akra (11kV)		16.7		3028		3106		78		1306		1306
	6TARD1	Taratala T1		1.6		34785		37837		3052		4883		4883

Southern 132 kV sytem

6TARD2	Taratala T2		16.0		2574		2749		174		2789		2789
6ELGD1	Elgin Rd. T1		16 0		4602		4728		126		2015		2015
33MTP1	MTP J D Park		1 0		395700		397172		1472		1472		1472
6KIDD1	Kidderpore T1		16 0		8203		8506		303		4851		4851
6KIDD2	Kidderpore T2		16 0		2926		3243		317		5072		5072
6BBGD1	Budge Budge T1		0 0		960356		1148519		188163		5645		5645
6BBGD2	Budge Budge T2		16 0		6521		6651		130		2084		2084
6SOUD1	Southern T1		16 0		9210		9506		297		4746		4746
6SOUD3	Southern T3		16 0		7899		8177		278		4446		4446
6SOUD4	Southern T4		15 0		8383		8903		520		7801		7801
6SHAD1	Shalimar T1		15 0		6447		6838		392		5875		5875
6SHAD2	Shalimar T2		15 0		3252		3577		325		4881		4881
6SHAD3	Shalimar T3		8 0		2807		3308		500		4002		4002
6HOWWD1	Howrah West T1		16 0		7436		7772		336		5383		5383
6HOWWD2	Howrah West T2		16 0		6329		6657		328		5254		5254
6BHOWD1	Bhowanipore		16 0		6645		6895		250		4008		4008
GKW	GKW												729
M	**Total Units Output Recorded at 6 kV Busbar.**												*82625*
N	**Units Loss in 33 kV Transmission & 33/6 kV Transformation (L-M)**												**2904**
	Percentage Loss												3.53

Note 1 Reading at Maj end adjusted to eliminate negative loss

Note 2 The negative loss repalced by technical losses in the two lines

Summary of energy audit result

Input to the selected network	(MkWh)	106032
Output energy recorded	(MkWh)	102226
Total enegy loss	(MkWh)	3806
Percentage loss	(%)	3.59%

Summary of Load Flow result

Swing Bus	(MW)	55 51
Generators	(MW)	100 40
Total operating Load	(MW)	152 99
Peak losses	(MW)	6 22
Iron Loss of transformers	(MW)	0 46
Dilectric Loss (132 and 33 kV lines)	(MW)	0 28
Study period		30
LLF		0 61
Energy loss (Technical)	(MkWh)	3258
	(%)	**3.07%**
Energy Loss (Non-technical)	(MkWh)	548
	(%)	**0.52%**

Energy Balance for Belur 132 KV Selected Network

Metering Point	Location	Identification	Initial Reading						Final Reading				Net import	Net export	Energy Advance
			Date	Import			Export		Date	Import		Export			
				Time	M F	Reading	M.F.	Reading		Time	Reading	Reading			
132WBL1	WBSEB (Lillooah)														
132WBL2	WBSEB (Lillooah)														
132WBL3	WBSEB (Lillooah)														
Input to 132 kV BRS system					1000			101 08				193 66	0	92 58	92580
								ZMC Meter			ZMC Meter				
33BRS4	Belur	T1						32890			67812		34922		
33BRS12	Belur	T2						14173			34921		20748		
33BRS15	Belur	T3						31808			66808		35000		
											Total input to 33 kV Belur Bus from WBSEB side (ZMC)				90670
Losses in the 132 KV lines and 132/33 KV transformation															1910
% Losses w.r.t. to 132 KV Input															2.06%
Other sources of import/export													a	b	a-b
33BRS33 (import/export)	BRS	NCGS 1A & 1B (new)	May-06		4	79948	4	21273	Jun-26		82909	21276	11844	12	11832
33BRS8 (LHS)	Belur	NC5					1	95444				100562	0	5118	-5118
33BRS16 (both lines)	Belur	NC4&6			3	102593	3	60820			104108	62158	4545	4014	531
33BRS11	Belur	NC3			1	33382	1	52841			33451	57987	69	5146	-5077
														sub-total (B)	2168
											TOTAL feed to the 33 kV selected network (A+B)				92838
6 & 11 kV Load Points															
6HND1	Howrah North 6KV				16	1689					2144		7280		
6FSD1	F Shore 6KV				15	5642					6123		7220		
6FSD2	F Shore 6KV				15	2006					2480		7111		
6BELD2	Bellur 6KV				1	29678					38926		9248		
6BELD3	Bellur 6KV				1	32509					36665		4156		
11BELD3	Bellur 11 kV				16 66	506					791		4749		
6BELD4	Bellur 6KV				20	8445					8936		9814		
11BELD4	Bellur 11 kV				16 66	4088					4144		937		
6LILD1	Lillooah 6KV				16	890					1270		6084		
6LILD2	Lillooah 6KV				16	5761					5995		3742		
11LILD2	Lillooah 11KV				16 66	6963					6989		432		
6BALD2	Bally 6KV				16	8314					8621		4912		
6HCFND1	Howrah Central 6KV				16	9453					10091		10212		
6HCFND2	Howrah Central 6KV				16	57					571		8220		
33IND1	Indal				30	350371					350604		6990		
ET	Bellur				1	161473					161473		0		
Capacitor Bank	Bellur				1	82128					91820		10		
													Total energy export at 6 kV system		91117
Losses in the 33 KV lines and 33/6 KV transformation															1721
% Losses in the 33 KV lines and 33/6 KV transformation w.r.t. total 33 KV input															1.85%
Total energy loss (132 and 33 KV system)															3631
% energy loss (132 and 33 KV system) w.r.t. 132 KV input															3.83%

Summary of energy audit result

Input to the selected network	(MkWh)	**94748**
Output energy recorded	(MkWh)	**91117**
Total enegy loss	(MkWh)	3631
Percentage loss	(%)	**3.83%**

Summary of Load Flow result

Swing Bus	(MW)	83.05
Generators	(MW)	5.90
Total operating Load	(MW)	86 94
Peak losses	(MW)	2.11
Iron Loss of transformers	(MW)	0 27
Dilectric Loss (132 and 33 kV lines)	(MW)	0.15
Study period		51
LLF		0.71
Energy loss (Technical)	(MkWh)	2345
	(%)	**2.48%**
Energy Loss (Non-technical)	(MkWh)	1286
	(%)	**1.36%**

Energy Balance for Park Lane 132 KV Selected Network

Metering Point	Location	Identification	Initial Reading						Final Reading						
			Date	Import			Export		Date	Import		Export	Net import	Net export	Energy Advance
				Time	M F.	Reading	M.F.	Reading		Time	Reading	Reading			
132PRS1	Prinsep St.	Prinsep-Park Lane	May 5th	10 30	2	121413	2		Jun-25	13 00	126422		10018	0	
132PLN4	Park Lane	Prinsep-Park Lane		10.15	2	73579	2	111201		12 55	73969	115820	0	9238	
132MAJ1	Majerhat	Majerhat-Park Lane		10.30	1	8419	1	499956		13 00	8419	557174	0	57218	
132PLN1	Park Lane	Majerhat-Park Lane		10 15	2	732440	2	1889		12.55	761389	1889	57898	0	
														Net energy into 132 KV Park Lane Bus	47980
33PLN5	Park Lane	T2		10:30	7.5	57268	7.5	59		12:45	60483	59	24113	0	
33PLN8	Park Lane	T1		10:30	7 5	161043	7.5	1479		12 45	164219	1479	23820	0	
														Net energy feed into 33 Kv Park Lane Bus from 132/33 kV Tr	47933
														Energy loss in the 132/33 Kv Transformers (T1 & T2)	0.10%
Import/Export to 33 kV Prinsep St.															
33PLN1				09:37	2	228521	2	36302		12:45	228521	37058	0	3520	
33PLN2				09:37	2	346848	2	348142		12:45	346848	349902	0	3520	
														Total export outside the selected area	7040
														Net energy feed into 33 Kv Park Lane Bus	40893
6 kV Load Points															
6PLN1	Park Lane			10:22			1.6	10676		10:00		14788		6579	
6PLN2	Park Lane			10:20			16	4698		10:00		5122		6783	
6ASQD1	Auckland Sq.			10:15			20	3882		10.00		4121		4785	
6ASQD2	Auckland Sq.			10 15			20	4208		10 00		4436		4540	
6PCIRD1	Park Circus			10.25			1 6	23888		10 00		30115		9963	
6MARD1	Marquis St.			10:40			0 03	255830		10 00		484445		6584	
														Total energy sent out from 6 kV Buses	39234
ET	Park Lane	T1		09:50			1	53328		12:45		55166		1838	
		T2		09:51			1	1057		12:45		1057		0	
														Sub-total of ET	2
Energy Loss in the 33 kV system															1656
% Loss w.r.t. 33 kV system input															4.05%

Note: Import from Prinsep Street has been ignored as indicated by CESC

Summary of energy audit result

Input to the selected network	(MkWh)	47980
Output energy recorded	(MkWh)	46276
Total enegy loss	(MkWh)	1704
Percentage loss	(%)	**3.55%**

Summary of Load Flow result

Swing Bus	(MW)	51.896
Generators	(MW)	
Total operating Load	(MW)	51.459
Peak losses	(MW)	0.570
Iron Loss of transformers	(MW)	0.138
Dilectric Loss (132 and 33 kV lines)	(MW)	0.006
Study period	(MW)	51
LLF		0.48
Energy loss (Technical)	(MkWh)	511
	(%)	**1.07%**
Energy Loss (Non-technical)	(MkWh)	1193
	(%)	**2.49%**

Annex 11

Load Flow Result of 132 kV Selected Network

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	54	55

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	24	0	0	37	0	0	61

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.000100 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename. Southern_132kV

Output Filename: C:\ETAPS\PowerStn\Southern_132kVNEW\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
6AKRD1	Load	6.00	100.0	0.0			9.801	4.747				
6BB1	Load	6.00	100.0	0.0			12.798	6.198				
6BB2	Load	6.00	100.0	0.0			5.104	2.755				
6BHOWD1	Load	6.00	100.0	0.0			10.903	5.885				
6ELGD1	Load	6.00	100.0	0.0			12.496	6.745				
6HRD1	Load	6.00	100.0	0.0			8.501	4.588				
6KID1	Load	6.00	100.0	0.0			10.899	5.279				
6KID2	Load	6.00	100.0	0.0			11.896	5.068				
6SOU10	Load	20.00	100.0	0.0			0.020	2.220				
6TARAD	Load	6.00	100.0	0.0			18.801	10.655				
33AKRD1	Load	33.00	100.0	0.0								
33BBGD	Load	33.00	100.0	0.0								
33BBGD2	Load	33.00	100.0	0.0								
33BHOWD1	Load	33.00	100.0	0.0								
33ELGD1	Load	33.00	100.0	0.0								
33ELGD2	Load	33.00	100.0	0.0								
33HOWWD1	Load	33.00	100.0	0.0								
33HOWWD2	Load	33.00	100.0	0.0								
33HRD1	Load	33.00	100.0	0.0								
33KIDD1	Load	33.00	100.0	0.0								
33KIDD2	Load	33.00	100.0	0.0								
33L/A3	Load	33.00	100.0	0.0								
33 L/A5 Kid	Load	33.00	100.0	0.0								
33L/A8	Load	33.00	100.0	0.0								
33L/A9	Load	33.00	100.0	0.0								
33MPT2	Load	33.00	100.0	0.0			1.503	0.728				
33SOU10	Load	33.00	100.0	0.0								
33TARAD1	Load	33.00	100.0	0.0								
33TARAD2	Load	33.00	100.0	0.0								
ALID1	Load	33.00	100.0	0.0								
ALID1 (Sec)	Load	6.00	100.0	0.0			9.099	3.876				
Bus1	Load	132.00	100.0	0.0	26.700	-8.800						
Bus5	Load	33.00	100.0	0.0								
Bus6	Load	33.00	100.0	0.0								
GKW	Load	33.00	100.0	0.0			1.998	0.968				
HOWWD1	Load	6.00	100.0	0.0			13.502	7.652				
HOWWD2	Load	6.00	100.0	0.0			13.901	5.922				

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mn
L/A2	Load	33.00	100.0	0.0								
L/A at RAJA	Load	33.00	100.0	0.0								
Majerhat	Load	132.00	100.0	0.0	26.700	-8.800						
MPT1	Load	33.00	100.0	0.0			1.296	0.628				
O/D Yard at Taratala	Load	33.00	100.0	0.0								
SHA1	Load	6.00	100.0	0.0			9.504	5.130				
SHAD1	Load	33.00	100.0	0.0								
SHAD2	Load	33.00	100.0	0.0								
SHAD3	Load	33.00	100.0	0.0								
SHAD3-2	Load	6.00	100.0	0.0			24.403	11.119				
SOU1-3	Load	6.00	100.0	0.0			17.002	7.243				
SOU4	Load	6.00	100.0	0.0			14.609	6.223				
SOUD1	Load	33.00	100.0	0.0								
SOUD3	Load	33.00	100.0	0.0								
SOUD4	Load	33.00	100.0	0.0								
Southern	Load	132.00	100.0	0.0								
Southern REC STN	Load	33.00	100.0	0.0	47.000	17.000						
WBSEB (Howrah)	SWNG	132.00	95.0	0.0								
55 Buses Total					100.400	-0.600	208.035	103.626	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
132MAJ1-SRS8			6422.0	1	75	.08700	.13900	.0000400
132MAJ2-SRS1			6203.0	1	75	.08700	.13900	.0000400
132WBH1-SRS2			2913.0	1	75	.17400	10500	.0000850
132WBH2-SRS5			2923.0	1	75	17400	.10500	0000850
132WBH3-SRS7			2868.0	1	75	.17400	.10500	.0000850
33KIDD2-L/A5			1500.0	1	75	.13700	.11000	.0001470
BBGD2-L/A7(OH)			10100.0	1	75	.18000	.28000	.0000050
HRS1-L/A8			2438.0	1	75	.14400	.11000	.0001010
HRS3-GKW2			1664.0	1	75	14400	11000	.0001010
HRS3-HOWWD2			5120.0	1	75	.13700	.10300	.0001470
L/A1-ALID1			1382.0	1	75	.13700	.10300	0001470
L/A1-MPT1			2488.0	1	75	.13700	.10300	.0001470
L/A2-AKRD1			4536.0	1	75	.13700	.10300	.0001470
L/A3-KIDD1			1500.0	1	75	.13700	10300	.0001470
L/A9-GKW3			1664.0	1	75	.14400	.11000	.0001010
L/A9-SHAD3			1656.0	1	75	.14400	.11000	0001010
SHAD1-L/A8			50.0	1	75	.13700	.10300	.0001470
SRS10-MTP2			10212.0	1	75	13700	10300	0001470
SRS11-BBGD2			13309.0	1	75	.13700	10300	.0001470
SRS13-L/A2			2946.0	1	75	.14400	.11000	0001010
SRS15-SHAD2			4104.0	1	75	.14400	.11000	0001010
SRS16-SOUD4			659.0	1	75	.13700	10300	.0001470
SRS17-L/A7			2931.0	1	75	.13700	.10300	.0001470
SRS19-SOUD1			559.0	1	75	14400	.11000	0001010
SRS1-SOU10			94.0	1	75	.13700	.10300	.0001470
SRS21-SOUD3			423.0	1	75	13700	.10300	0001470
SRS23-L/A9			2850.0	1	75	14400	.11000	0001010
SRS25-HOWWD1			8195.0	1	75	13700	.10300	0001470
SRS26-L/A5			4803.0	1	75	.14400	.11000	.0001010
SRS27-BHOWD1			10260.0	1	75	.13700	.10300	0001470
SRS28-TARAD2			2862.0	1	75	.13700	.10300	0001470
SRS2-L/A1			7816.0	1	75	.13700	.10300	.0001470
SRS3-HRD1			3237.0	1	75	.13700	.10300	.0001470
SRS4-TARAD1			2763.0	1	75	.13700	.10300	.0001470
SRS6-ELGD1A			8773.0	1	75	.14000	.11000	.0001190

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
SRS7-L/A3			4729.0	1	75	14400	11000	0001010
SRS8-HRS1			2703.0	1	75	.18900	10800	0001290

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol
AKRA	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
Alipore	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
BB-T1	15.000	33.000	6.000	11.420	18.1	0.000	0.000	0.00
BB-T2	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
ELT1	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
ELT2	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
HIDE Rd	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
Kid-T1	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
Kid-T2	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
SHA-2	15.000	33.000	6.000	11.420	18.1	0.000	0.000	0.00
SHA-T1	15.000	33.000	6.000	11.420	18.1	0.000	0.000	0.00
SHA-T3	15.000	33.000	6.000	11.420	18.1	0.000	0.000	0.00
Southern 20	10.000	33.000	20.000	9.540	10.7	0.000	0.000	0.00
S-T1	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
S-T3	15.000	33.000	6.000	11.420	18.1	0.000	0.000	0.00
S-T4	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
T1	55.000	132.000	33.000	11.210	23.2	0.000	5.000	0.00
T2	55.000	132.000	33.000	11.210	22.6	0.000	5.000	0.00
T3	55.000	132.000	33.000	11.200	22.6	0.000	5.000	0.00
T11	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
Tara-T1	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
Tara-T2	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
West-T1	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00
West-T2	16.000	33.000	6.000	12.210	21.8	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	**Rating**			**Tap**	**Impedance**			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	**Bus Numbers ("*" LTC Side)**			**Transformer Load Tap Changer Setting**					
ID	Prim. Bus ID	Sec. Bus ID	Ter. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	**Connected Buses**		**Impedance**		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
AKRA	2W XFMR	33AKRD1	6AKRD1	3.50	76.23	76.31	
Alipore	2W XFMR	ALID1	ALID1 (Sec)	3.42	74.43	74.51	
BB-T1	2W XFMR	33BBGD2	6BB1	3.83	69.37	69.47	
BB-T2	2W XFMR	33BBGD	6BB2	3.37	73.40	73.47	
ELT1	2W XFMR	33ELGD1	6ELGD1	3.41	74.33	74.40	
ELT2	2W XFMR	33ELGD2	6ELGD1	3.41	74.33	74.40	
HIDE Rd	2W XFMR	33HRD1	6HRD1	3.41	74.33	74.40	
Kid-T1	2W XFMR	33KIDD1	6KID1	3.37	73.37	73.45	
Kid-T2	2W XFMR	33KIDD2	6KID2	3.41	74.33	74.40	
SHA-2	2W XFMR	SHAD2	SHAD3-2	3.94	71.27	71.38	
SHA-T1	2W XFMR	SHAD1	SHA1	4.09	74.12	74.23	
SHA-T3	2W XFMR	SHAD3	SHAD3-2	3.94	71.27	71.38	
Southern 20	2W XFMR	33SOU10	6SOU10	8.90	94.98	95.40	
S-T1	2W XFMR	SOUD1	SOU1-3	3.41	74.33	74.40	
S-T3	2W XFMR	SOUD3	SOU1-3	4.09	74.12	74.23	
S-T4	2W XFMR	SOUD4	SOU4	3.32	72.42	72.50	
T1	2W XFMR	Southern	Southern REC	0.87	20.16	20.18	
T2	2W XFMR	Southern	Southern REC	0.89	20.16	20.18	
T3	2W XFMR	Southern	Southern REC	0.89	20.14	20.16	
T11	2W XFMR	33BHOWD1	6BHOWD1	3.50	76.23	76.31	
Tara-T1	2W XFMR	33TARAD1	6TARAD	3.50	76.23	76.31	
Tara-T2	2W XFMR	33TARAD2	6TARAD	3.50	76.23	76.31	
West-T1	2W XFMR	33HOWWD1	HOWWD1	3.50	76.23	76.31	
West-T2	2W XFMR	33HOWWD2	HOWWD2	3.50	76.23	76.31	
33KIDD2-L/A5	Line/Cable	33KIDD2	33 L/A5 Kid	1.89	1.52	2.42	0.2401245
132MAJ1-SRS8	Line/Cable	Majerhat	Southern	0.32	0.51	0.60	4.4758773
132MAJ2-SRS1	Line/Cable	Bus1	Southern	0.31	0.49	0.58	4.3232427
132WBH1-SRS2	Line/Cable	WBSEB (Howra	Southern	0.29	0.18	0.34	4.3142695
132WBH2-SRS5	Line/Cable	WBSEB (Howra	Southern	0.29	0.18	0.34	4 3290796
132WBH3-SRS7	Line/Cable	WBSEB (Howra	Southern	0 29	0.17	0.33	4.2476225
HRS1-L/A8	Line/Cable	33L/A8	Bus5	3.22	2.46	4.06	0.2681532
HRS3-GKW2	Line/Cable	Bus6	GKW	2.20	1.68	2.77	0.1830217
HRS3-HOWWD 2	Line/Cable	33HOWWD2	Bus6	6.44	4.84	8.06	0.8196250
L/A1-ALID1	Line/Cable	L/A at RAJA	ALID1	1.74	1.31	2.18	0.2212347
L/A1-MPT1	Line/Cable	L/A at RAJA	MPT1	3.13	2.35	3.92	0.3982865
L/A2-AKRD1	Line/Cable	L/A2	33AKRD1	5.71	4.29	7.14	0.7261364
L/A3-KIDD1	Line/Cable	33L/A3	33KIDD1	1.89	1.42	2.36	0.2401245
L/A9-GKW3	Line/Cable	33L/A9	GKW	2.20	1.68	2.77	0.1830217
L/A9-SHAD3	Line/Cable	SHAD3	33L/A9	2.19	1.67	2.76	0.1821418

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
SHAD1-L/A8	Line/Cable	33L/A8	SHAD1	0.06	0.05	0.08	0.0080042
SRS1-SOU10	Line/Cable	Southern REC	33SOU10	0.12	0.09	0.15	0.0150478
SRS2-L/A1	Line/Cable	Southern REC	L/A at RAJA	9.83	7.39	12.30	1.2512087
SRS3-HRD1	Line/Cable	Southern REC	33HRD1	4.07	3.06	5.09	0.5181887
SRS4-TARAD1	Line/Cable	Southern REC	33TARAD1	3.48	2.61	4.35	0.4423093
SRS6-ELGD1A	Line/Cable	Southern REC	33ELGD1	11.28	8.86	14.34	1.1369017
SRS7-L/A3	Line/Cable	Southern REC	33L/A3	6.25	4.78	7.87	0.5201380
SRS8-HRS1	Line/Cable	Southern REC	Bus5	4.69	2.68	5.40	0.3797201
SRS10-MTP2	Line/Cable	Southern REC	33MPT2	12.85	9.66	16.07	1.6347677
SRS11-BBGD2	Line/Cable	Southern REC	33BBGD	16.74	12.59	20.95	2.1305447
SRS13-L/A2	Line/Cable	Southern REC	L/A2	3.90	2.98	4.90	0.3240276
SRS15-SHAD2	Line/Cable	Southern REC	SHAD2	5.43	4.15	6.83	0.4513949
SRS16-SOUD4	Line/Cable	Southern REC	SOUD4	0.83	0.62	1.04	0.1054947
SRS17-L/A7	Line/Cable	Southern REC	O/D Yard at	3.69	2.77	4.61	0.4692032
SRS19-SOUD1	Line/Cable	Southern REC	SOUD1	0.74	0.56	0.93	0.0614838
SRS21-SOUD3	Line/Cable	Southern REC	SOUD3	0.53	0.40	0.67	0.0677151
SRS23-L/A9	Line/Cable	Southern REC	33L/A9	3.77	2.88	4.74	0.3134686
SRS25-HOWWD1	Line/Cable	Southern REC	33HOWWD1	10.31	7.75	12.90	1.3118801
SRS26-L/A5	Line/Cable	Southern REC	33 L/A5 Kid	6.35	4.85	7.99	0.5282772
SRS27-BHOWD1	Line/Cable	Southern REC	33BHOWD1	12.91	9.70	16.15	1.6424516
SRS28-TARAD2	Line/Cable	33TARAD2	Southern REC	3.60	2.71	4.50	0.4581575
BBGD2-L/A7(O	XmitLine	O/D Yard at	33BBGD2	16.69	25.97	30.87	0.0549945

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R(

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
6AKRD1	Load	6.000	5.429	-11.7	0.00	0.00	9.80	4.75	0.00	0.00	33AKRD1	-9.80	-4.75	1158	90.00	
6BB1	Load	6.000	5.630	-13.9	0.00	0.00	12.80	6.20	0.00	0.00	33BBGD2	-12.80	-6.20	1458	90.00	
6BB2	Load	6.000	5.801	-9.2	0.00	0.00	5.10	2.75	0.00	0.00	33BBGD	-5.10	-2.75	577	88.00	
6BHOWD1	Load	6.000	5.308	-12.5	0.00	0.00	10.90	5.88	0.00	0.00	33BHOWD1	-10.90	-5.88	1347	88.00	
6ELGD1	Load	6.000	5.400	-13.0	0.00	0.00	12.50	6.74	0.00	0.00	33ELGD1	-12.50	-6.74	1518	88.00	
											33ELGD2	0.00	0.00	0	0.00	
6HRD1	Load	6.000	5.657	-10.7	0.00	0.00	8.50	4.59	0.00	0.00	33HRD1	-8.50	-4.59	985	88.00	
6KID1	Load	6.000	5.634	-11.9	0.00	0.00	10.90	5.28	0.00	0.00	33KIDD1	-10.90	-5.28	1240	90.00	
6KID2	Load	6.000	5.549	-12.6	0.00	0.00	11.90	5.07	0.00	0.00	33KIDD2	-11.90	-5.07	1345	92.00	
6SOU10	Load	20.000	18.872	-6.6	0.00	0.00	0.02	2.22	0.00	0.00	33SOU10	-0.02	-2.22	67	0.90	
6TARAD	Load	6.000	5.457	-11.4	0.00	0.00	18.80	10.65	0.00	0.00	33TARAD1	-9.40	-5.34	1143	86.97	
											33TARAD2	-9.40	-5.32	1142	87.03	
33AKRD1	Load	33.000	31.415	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	L/A2	-9.85	-5.85	210	85.98	
											6AKRD1	9.85	5.85	210	85.98	
33BBGD	Load	33.000	31.492	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-5.12	-3.03	109	86.05	
											6BB2	5.12	3.03	109	86.05	-3
33BBGD2	Load	33.000	30.096	-8.1	0.00	0.00	0.00	0.00	0.00	0.00	O/D Yard at	-12.89	-7.94	290	85.14	
											6BB1	12.89	7.94	290	85.14	-8
33BHOWD1	Load	33.000	31.157	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-10.97	-7.38	245	82.98	
											6BHOWD1	10.97	7.38	245	82.98	
33ELGD1	Load	33.000	31.129	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-12.58	-8.64	283	82.43	
											6ELGD1	12.58	8.64	283	82.43	-2
33ELGD2	Load	33.000	28.957	-13.0	0.00	0.00	0.00	0.00	0.00	0.00	6ELGD1	0.00	0.00	0	0.00	-2
33HOWWD1	Load	33.000	31.128	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-13.62	-10.12	314	80.27	
											HOWWD1	13.62	10.12	314	80.27	
33HOWWD2	Load	33.000	30.573	-7.1	0.00	0.00	0.00	0.00	0.00	0.00	Bus6	-14.01	-8.27	307	86.11	
											HOWWD2	14.01	8.27	307	86.11	
33HRD1	Load	33.000	31.704	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-8.54	-5.39	183	84.57	
											6HRD1	8.54	5.39	183	84.57	-2
33KIDD1	Load	33.000	31.436	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	33L/A3	-10.96	-6.55	234	85.85	
											6KID1	10.96	6.55	234	85.85	-3
33KIDD2	Load	33.000	31.399	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	33 L/A5 Kid	-11.96	-6.56	250	87.69	
											6KID2	11.96	6.56	250	87.69	-2
33L/A3	Load	33.000	31.539	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	33KIDD1	10.99	6.35	232	86.58	
											Southern REC	-10.99	-6.35	232	86.58	
33 L/A5 Kid	Load	33.000	31.511	-6.9	0.00	0.00	0.00	0.00	0.00	0.00	33KIDD2	12.00	6.37	248	88.33	
											Southern REC	-12.00	-6.37	248	88.33	

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
33L/A8	Load	33.000	31.512	-6.8	0 00	0.00	0.00	-0 01	0.00	0.00	Bus5	-9.57	-6.14	208	84 15	
											SHAD1	9.57	6.15	208	84.13	
33L/A9	Load	33.000	31.360	-6 9	0.00	0.00	0.00	0 00	0.00	0.00	GKW	16.35	8.46	338	88.82	
											SHAD3	12.08	6.22	250	88.89	
											Southern REC	-28.43	-14 68	588	88.85	
33MPT2	Load	33.000	31.812	-6.8	0.00	0.00	1.50	0.73	0.00	0.00	Southern REC	-1.50	-0.73	30	90.00	
33SOU10	Load	33.000	31.877	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-0.02	-2.27	41	1.06	
											6SOU10	0.02	2.27	41	1.10	
33TARAD1	Load	33 000	31.709	-6 8	0.00	0 00	0.00	0.00	0.00	0.00	Southern REC	-9.45	-6.41	207	82.74	
											6TARAD	9.45	6 42	207	82.74	
33TARAD2	Load	33.000	31.703	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-9.45	-6.39	207	82.82	
											6TARAD	9.45	6.39	207	82.82	
ALID1	Load	33.000	31.336	-7.0	0.00	0.00	0 00	0.00	0 00	0.00	L/A at RAJA	-9.14	-4.73	189	88.81	
											ALID1 (Sec)	9.14	4.73	189	88.81	
ALID1 (Sec)	Load	6.000	5.609	-11.3	0.00	0.00	9.10	3.88	0 00	0.00	ALID1	-9.10	-3.88	1018	92.00	
Bus1	Load	132.000	125.207	0.1	26.70	-8.80	0 00	0.00	0.00	0 00	Southern	26.70	-8.80	129	-94.97	
Bus5	Load	33.000	31.669	-6.7	0.00	0 00	0.00	0.00	0 00	0.00	33L/A8	9.61	5.93	205	85.10	
											Southern REC	-9.61	-5.93	205	85 10	
Bus6	Load	33 000	31.031	-7.0	0 00	0 00	0 00	0.00	0 00	0 00	GKW	-14.20	-7 70	300	87 90	
											33HOWWD2	14.20	7 70	300	87.90	
GKW	Load	33.000	31.185	-7 0	0.00	0 00	2.00	0 97	0 00	0.00	Bus6	14.27	7.59	299	88.28	
											33L/A9	-16.27	-8.56	340	88.50	
HOWWD1	Load	6 000	5 178	-13.9	0 00	0 00	13.50	7.65	0.00	0.00	33HOWWD1	-13.50	-7.65	1730	87.00	
HOWWD2	Load	6 000	5 163	-14 6	0.00	0 00	13.90	5 92	0 00	0 00	33HOWWD2	-13.90	-5 92	1689	92.00	
L/A2	Load	33.000	31 692	-6 8	0 00	0 00	0.00	0 00	0.00	0 00	33AKRD1	9.93	5.25	204	88.42	
											Southern REC	-9.93	-5 25	204	88.42	
L/A at RAJA	Load	33.000	31.412	-7.0	0.00	0 00	0 00	0 00	0 00	0.00	ALID1	9.16	4 54	187	89.58	
											MPT1	1.30	0.27	24	97.94	
											Southern REC	-10 45	-4 81	211	90.84	
Majerhat	Load	132 000	125 210	0 1	26.70	-8 80	0 00	0 00	0.00	0 00	Southern	26.70	-8 80	129	-94.97	
MPT1	Load	33.000	31 394	-7 0	0 00	0 00	1 30	0 63	0 00	0.00	L/A at RAJA	-1.30	-0 63	26	90.00	
O/D Yard at	Load	33 000	31 628	-6 8	0 00	0 00	0 00	0 00	0 00	0.00	Southern REC	-13.35	-8.61	290	84.04	
											33BBGD2	13.35	8.61	290	84.04	
SHA1	Load	6 000	5.581	-11.2	0.00	0 00	9.50	5.13	0.00	0.00	SHAD1	-9.50	-5.13	1117	88.00	
SHAD1	Load	33.000	31.508	-6.8	0 00	0.00	0 01	0.01	0.00	0 00	33L/A8	-9.57	-6.16	208	84.10	
											SHA1	9.56	6 15	208	84.08	

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
SHAD2	Load	33.000	31.535	-6.8	0.00	0.00	0 00	0 00	0 00	0.00	Southern REC	-12.54	-7.74	269	85.10	
											SHAD3-2	12.54	7.74	269	85.10	-6
SHAD3	Load	33.000	31 232	-7 0	0.00	0 00	0 00	0.00	0.00	0.00	33L/A9	-12.03	-6.35	251	88.43	
											SHAD3-2	12.03	6.35	251	88.43	-6
SHAD3-2	Load	6.000	5.764	-12.2	0.00	0 00	24.40	11.12	0 00	0.00	SHAD2	-12.45	-6.15	1390	89.66	
											SHAD3	-11.96	-4.97	1296	92.34	
SOU1-3	Load	6.000	5.733	-10.6	0.00	0.00	17.00	7 24	0.00	0 00	SOUD1	-8.47	-3.64	928	91.87	
											SOUD3	-8.53	-3.60	932	92.13	
SOU4	Load	6 000	5 720	-13.2	0.00	0.00	14.61	6.22	0.00	0.00	SOUD4	-14.61	-6.22	1602	92.00	
SOUD1	Load	33 000	31.848	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-8.50	-4.35	173	89.02	
											SOU1-3	8.50	4.35	173	89.02	-2
SOUD3	Load	33.000	31.856	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-8.57	-4.32	173	89.32	
											SOU1-3	8.57	4.32	173	89.32	-2
SOUD4	Load	33.000	31.818	-6.8	0.00	0.00	0.00	0.00	0.00	0.00	Southern REC	-14.71	-8.34	306	86.99	
											SOU4	14.71	8.34	306	86.99	-5
Southern	Load	132.000	125.139	0 0	0.00	0.00	0.00	0.00	0.00	0.00	Majerhat	-26.67	4.82	125	-98.41	
											Bus1	-26.67	4.95	125	-98.32	
											WBSEB (Howra	-37 69	-46.08	274	63.32	
											WBSEB (Howra	-37.56	-45.93	273	63.31	
											WBSEB (Howra	-38.28	-46.74	278	63.37	
											Southern REC	55.58	43.02	324	79.08	-5
											Southern REC	55.63	42.96	324	79.15	-5
											Southern REC	55.68	43.00	324	79.15	-5

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Southern REC	Load	33 000	31 878	-6.8	47.00	17.00	0.01	0.00	0.00	0.00	33SOU10	0.02	2.26	40	1.07	
											L/A at RAJA	10.59	3 77	203	94.22	
											33HRD1	8.58	4.94	179	86.66	
											33TARAD1	9.50	6 04	203	84.39	
											33ELGD1	12.87	7.83	272	85.43	
											33L/A3	11.10	5.96	228	88.12	
											Bus5	9.68	5.62	202	86.49	
											33MPT2	1.51	-0.79	30	-88.51	
											33BBGD	5.17	1.11	95	97.79	
											L/A2	9.98	4.99	202	89.46	
											SHAD2	12.66	7.42	265	86.29	
											SOUD4	14.73	8.26	305	87.23	
											O/D Yard at	13.45	8.25	285	85.24	
											SOUD1	8.51	4 30	172	89.26	
											SOUD3	8.58	4.26	173	89.58	
											33L/A9	28.85	14.72	586	89.08	
											33HOWWD1	13.94	9.16	302	83 56	
											33 L/A5 Kid	12.13	5 98	244	89.69	
											33BHOWD1	11.21	6.06	230	87 97	
											33TARAD2	9.50	6 00	203	84.52	
											Southern	-55.15	-33.07	1164	85.76	5
											Southern	-55.19	-33.01	1164	85.82	5
											Southern	-55.24	-33.04	1165	85.82	5
* WBSEB (Howra	Swng	132.000	125 400	0 0	113 86	127.33	0 00	0.00	0.00	0.00	Southern	37.80	42.26	261	66 67	
											Southern	37.67	42 10	260	66.68	
											Southern	38.39	42 98	265	66.62	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0 1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
* 6AKRD1	6.000	90 477	5 429	* 6BB1	6.000	93.841	5.630	# 6BB2	6.000	96.682	5.801
* 6BHOWD1	6.000	88 467	5.308	* 6ELGD1	6.000	89 997	5.400	* 6HRD1	6.000	94.283	5.657
* 6KID1	6.000	93.902	5.634	* 6KID2	6.000	92.487	5.549	* 6SOU10	20.000	94.360	18.872
* 6TARAD	6.000	90.945	5.457	# 33AKRD1	33.000	95.198	31.415	# 33BBGD	33.000	95.429	31.492
* 33BBGD2	33.000	91.201	30.096	* 33BHOWD1	33.000	94.415	31.157	* 33ELGD1	33.000	94.330	31.129
* 33ELGD2	33.000	87 747	28.957	* 33HOWWD1	33.000	94.327	31.128	* 33HOWWD2	33.000	92.644	30.573
# 33HRD1	33.000	96.073	31.704	# 33KIDD1	33.000	95 261	31.436	# 33KIDD2	33.000	95.149	31.399
# 33L/A3	33.000	95 574	31.539	# 33 L/A5 Kid	33.000	95.489	31.511	# 33L/A8	33.000	95.490	31.512
# 33L/A9	33.000	95 031	31.360	# 33MPT2	33.000	96 401	31.812	# 33SOU10	33.000	96.597	31.877
# 33TARAD1	33.000	96.088	31.709	# 33TARAD2	33.000	96.070	31.703	* ALID1	33.000	94.957	31.336
* ALID1 (Sec)	6.000	93.483	5.609	* Bus1	132.000	94 854	125.207	# Bus5	33.000	95.968	31.669
* Bus6	33 000	94 032	31.031	* GKW	33.000	94 501	31.185	* HOWWD1	6.000	86.302	5.178
* HOWWD2	6.000	86.042	5.163	# L/A2	33.000	96 038	31.692	# L/A at RAJA	33.000	95.188	31.412
* Majerhat	132.000	94 856	125.210	# MPT1	33.000	95 135	31.394	# O/D Yard at	33.000	95.842	31.628
* SHA1	6.000	93 017	5.581	# SHAD1	33.000	95 480	31.508	# SHAD2	33.000	95.560	31.535
* SHAD3	33.000	94 641	31 232	# SHAD3-2	6.000	96 071	5.764	# SOU1-3	6.000	95.546	5.733
# SOU4	6.000	95 332	5.720	# SOUD1	33.000	96 508	31.848	# SOUD3	33.000	96.534	31.856
# SOUD4	33.000	96 419	31.818	* Southern	132.000	94 803	125.139	# Southern REC	33.000	96.599	31.878
* WBSEB (Howra	132.000	95.000	125.400								

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
AKRA	Transformer				16.000	11.458	71.61	10.890	68.06
Alipore	Transformer				16 000	10.289	64.31	9.890	61.81
BB-T1	Transformer				15.000	15.145	100.97	14.220	94.80
BB-T2	Transformer				16.000	5.946	37.16	5.800	36.25
ELT1	Transformer				16.000	15.265	95.41	14.200	88.75
ELT2	Transformer				16.000	0.000	0.00	0.000	0.00
HIDE Rd	Transformer				16.000	10.096	63.10	9.660	60.37
Kid-T1	Transformer				16.000	12.764	79.77	12.110	75.69
Kid-T2	Transformer				16.000	13.643	85.27	12.930	80.81
SHA-2	Transformer				15.000	14.730	98.20	13.884	92.56
SHA-T1	Transformer				15.000	11.370	75.80	10.800	72.00
SHA-T3	Transformer				15.000	13.605	90.70	12.947	86.32
Southern 20	Transformer				10.000	2.273	22.73	2.220	22.20
S-T1	Transformer				16.000	9.550	59.69	9.218	57.62
S-T3	Transformer				15.000	9.597	63.98	9.262	61.74
S-T4	Transformer				16.000	16.905	105.66	15.879	99.24
* T1	Transformer				55.000	70.283	127.79	64.306	116.92
* T2	Transformer				55.000	70.283	127.79	64.306	116.92
* T3	Transformer				55 000	70.346	127.90	64.363	117.02
T11	Transformer				16.000	13.223	82.64	12.390	77.44
Tara-T1	Transformer				16.000	11.424	71.40	10.812	67.58
Tara-T2	Transformer				16.000	11.406	71.29	10.798	67.49
West-T1	Transformer				16.000	16.963	106.02	15.520	97.00
West-T2	Transformer				16.000	16.269	101.68	15.110	94.44

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		% in
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	
AKRA	6AKRD1	33AKRD1	-9.8	-4.7	9.9	5.9	50.7	1104 4	90.5	95.2	
BB-T1	6BB1	33BBGD2	-12.8	-6.2	12.9	7.9	96.4	1745.5	93.8	91.2	
BB-T2	6BB2	33BBGD	-5.1	-2.8	5.1	3.0	12.6	274.3	96.7	95.4	
T11	6BHOWD1	33BHOWD1	-10.9	-5.9	11.0	7.4	68.6	1495.3	88.5	94.4	
ELT1	6ELGD1	33ELGD1	-12.5	-6.7	12.6	8.6	87.1	1897.8	90.0	94.3	
ELT2	6ELGD1	33ELGD2	0.0	0.0	0.0	0.0	0.0	0.0	90.0	87.7	
HIDE Rd	6HRD1	33HRD1	-8.5	-4.6	8.5	5.4	36.7	800.3	94.3	96.1	
Kid-T1	6KID1	33KIDD1	-10.9	-5.3	11.0	6.5	58.2	1267.9	93.9	95.3	
Kid-T2	6KID2	33KIDD2	-11.9	-5.1	12.0	6.6	68 4	1490.0	92.5	95.1	
Southern 20	6SOU10	33SOU10	0.0	-2.2	0.0	2.3	4.9	52.6	94.4	96.6	
Tara-T1	6TARAD	33TARAD1	-9.4	-5.3	9.5	6.4	49.4	1077.5	90.9	96.1	
Tara-T2	6TARAD	33TARAD2	-9.4	-5.3	9.4	6.4	49.3	1074.6	90.9	96.1	
L/A2-AKRD1	33AKRD1	L/A2	-9.9	-5.9	9.9	5.2	80.3	-603.5	95.2	96.0	
SRS11-BBGD2	33BBGD	Southern REC	-5.1	-3.0	5.2	1.1	55.9	-1922.1	95.4	96.6	
BBGD2-L/A7(O	33BBGD2	O/D Yard at	-12.9	-7.9	13.4	8.6	459.6	666.9	91.2	95 8	
SRS27-BHOWD	33BHOWD1	Southern REC	-11.0	-7.4	11.2	6.1	238.3	-1319.2	94.4	96.6	
SRS6-ELGD1A	33ELGD1	Southern REC	-12.6	-8 6	12.9	7.8	284 6	-812.6	94.3	96 6	
SRS25-HOWWE	33HOWWD1	Southern REC	-13.6	-10.1	13.9	9.2	320.1	-955.0	94.3	96.6	
West-T1	33HOWWD1	HOWWD1	13.6	10.1	-13.5	-7.7	113.1	2465.3	94.3	86.3	
HRS3-HOWWD	33HOWWD2	Bus6	-14 0	-8.3	14.2	7.7	194.4	-568.0	92.6	94.0	
West-T2	33HOWWD2	HOWWD2	14.0	8.3	-13.9	-5.9	107.9	2351.0	92.6	86.0	
SRS3-HRD1	33HRD1	Southern REC	-8.5	-5.4	8.6	4.9	43.9	-447.9	96 1	96.6	
L/A3-KIDD1	33KIDD1	33L/A3	-11 0	-6.5	11.0	6.4	33.6	-193 4	95.3	95.6	
33KIDD2-L A5	33KIDD2	33 L/A5 Kid	-12 0	-6.6	12.0	6.4	38.5	-187.3	95.1	95.5	
SRS7-L/A3	33L/A3	Southern REC	-11.0	-6 4	11 1	6.0	108.3	-397.5	95.6	96.6	
SRS26-L/A5	33 L/A5 Kid	Southern REC	-12.0	-6 4	12.1	6.0	126.5	-390.7	95.5	96.6	
HRS1-L/A8	33L/A8	Bus5	-9.6	-6 1	9.6	5 9	45.2	-211.2	95 5	96.0	
SHAD1-L A8	33L/A8	SHAD1	9 6	6 2	-9 6	-6 2	0.9	-6.6	95.5	95.5	
L A9-GKW3	33L/A9	GKW	16 3	8 5	-16.3	-8.6	82.9	-101.0	95 0	94.5	
L/A9-SHAD3	33L/A9	SHAD3	12.1	6 2	-12 0	-6.4	45 0	-129.4	95 0	94.6	
SRS23-L A9	33L/A9	Southern REC	-28 4	-14.7	28.9	14 7	425.4	37.2	95.0	96.6	
SRS10-MTP2	33MPT2	Southern REC	-1.5	-0.7	1.5	-0.8	3 1	-1520.0	96 4	96.6	
SRS1-SOU10	33SOU10	Southern REC	0.0	-2.3	0.0	2.3	0.1	-14.0	96.6	96.6	
SRS4-TARAD1	33TARAD1	Southern REC	-9.5	-6.4	9.5	6.0	48.2	-374.3	96.1	96.6	
SRS28-TARAD2	33TARAD2	Southern REC	-9.4	-6 4	9.5	6.0	49.7	-387.8	96.1	96.6	
L/A1-ALID1	ALID1	L/A at RAJA	-9.1	-4.7	9.2	4.5	20.2	-184.8	95.0	95.2	

Project:	CESC Technical Loss Estimation	**PowerStation** 3.0.1C	Page:	19
Location.	TERI		Date:	01-08-2002
Contract.			SN:	TATAENERGY
Engineer		Study Case: LF	Revision:	Base
Filename.	Southern_132kV		Config.:	Normal

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		% in
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	
Alipore	ALID1	ALID1 (Sec)	9.1	4 7	-9.1	-3.9	39.2	853.2	95.0	93.5	
132MAJ2-SRS1	Bus1	Southern	26.7	-8.8	-26.7	5.0	26.2	-3845.8	94.9	94.8	
SRS8-HRS1	Bus5	Southern REC	-9.6	-5.9	9.7	5.6	64.0	-315.5	96.0	96.6	
HRS3-GKW2	Bus6	GKW	-14.2	-7.7	14.3	7.6	64.7	-113.2	94.0	94.5	
SRS13-L A2	L/A2	Southern REC	-9.9	-5.2	10.0	5.0	52.6	-260.4	96.0	96.6	
L/A1-MPT1	L/A at RAJA	MPT1	1.3	0.3	-1.3	-0.6	0.7	-360.2	95.2	95.1	
SRS2-L/A1	L/A at RAJA	Southern REC	-10.5	-4.8	10.6	3.8	138.2	-1046.7	95.2	96.6	
132MAJ1-SRS8	Majerhat	Southern	26.7	-8.8	-26.7	4.8	27.0	-3981.8	94.9	94.8	
SRS17-L/A7	O/D Yard at	Southern REC	-13.4	-8.6	13.5	8.3	99.9	-359.3	95.8	96.6	
SHA-T1	SHA1	SHAD1	-9.5	-5.1	9.6	6.2	56.6	1024.8	93.0	95.5	
SRS15-SHAD2	SHAD2	Southern REC	-12.5	-7.7	12.7	7.4	127.1	-319.6	95.6	96.6	
SHA-2	SHAD2	SHAD3-2	12.5	7.7	-12.4	-6.1	87.7	1587.6	95.6	96.1	
SHA-T3	SHAD3	SHAD3-2	12.0	6.4	-12.0	-5.0	76.3	1380.7	94.6	96.1	
S-T1	SOU1-3	SOUD1	-8.5	-3.6	8.5	4.4	32.6	709.6	95.5	96.5	
S-T3	SOU1-3	SOUD3	-8.5	-3.6	8.6	4.3	39.5	714.3	95.5	96.5	
S-T4	SOU4	SOUD4	-14.6	-6.2	14.7	8.3	97.1	2115.0	95.3	96.4	
SRS19-SOUD1	SOUD1	Southern REC	-8.5	-4.4	8.5	4.3	7.2	-51.8	96.5	96.6	
SRS21-SOUD3	SOUD3	Southern REC	-8.6	-4.3	8.6	4 3	5.2	-59.2	96.5	96.6	
SRS16-SOUD4	SOUD4	Southern REC	-14.7	-8.3	14.7	8.3	25.4	-79.2	96.4	96.6	
132WBH1-SRS2	Southern	WBSEB (Howra	-37.7	-46.1	37 8	42.3	109.0	-3819.7	94.8	95.0	
132WBH2-SRS5	Southern	WBSEB (Howra	-37.6	-45.9	37.7	42.1	108.7	-3833.3	94.8	95.0	
132WBH3-SRS7	Southern	WBSEB (Howra	-38.3	-46.7	38.4	43.0	110.7	-3758.7	94.8	95.0	
T1	Southern	Southern REC	55.6	43.0	-55.1	-33.1	428.3	9949.0	94.8	96.6	
T2	Southern	Southern REC	55.6	43.0	-55.2	-33.0	439.6	9948.5	94.8	96.6	
T3	Southern	Southern REC	55.7	43.0	-55.2	-33.0	440.0	9957.4	94.8	96.6	
							6311.5	23109.6			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es)	113.865	127.331	170.817	66.66 Lagging
Generators:	100.400	-0 600	100.402	100.00 Leading
Total Demand.	214.265	126.731	248.938	86.07 Lagging
Total Motor Load:	208.048	103.624	232.426	89.51 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	6.217	23.107		
System Mismatch:	0.024	0.023		

Number of Iterations: 5

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses.	1	0	23	24

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	14	0	0	15	0	1	30

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration 99

Precision of Solution 0.000900 MW and Mvar

System Frequency 50.00

Unit System Metric

Project Filename: Belur132kV

Output Filename: C:\ETAPS\PowerStn\Belur-132kv\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	Max	M
6Belur	Load	6 00	89 8	-9.9			20.018	9.120				
33FSD1	Load	33 00	89.5	-6.3								
33FSD2	Load	33.00	89.5	-6.3								
33HND1	Load	33.00	92 5	-6.2								
33IND1	Load	33.00	92.9	-6.1			5.923	2.869				
33IND2	Load	33.00	92.9	-6.1								
33NCG	Load	33.00	93.0	-6.1	5.900	2.800						
BALD2	Load	6.00	85.3	-13.8			13.939	5.938				
BELUR REC STN	Load	33 00	93.0	-6.1								
BRS1	Load	132.00	99.8	0.0								
BRS2	Load	132.00	99.8	0.0								
BRS3	Load	132.00	99.8	0.0								
Bus22	Load	33.00	92.7	-6.2								
Bus23	Load	33.00	92.8	-6.2								
Bus24	Load	33 00	92.1	-6.2								
Bus25	Load	33.00	91.8	-6.2								
Bus26	Load	33.00	92 0	-6.2								
FORESHORE	Load	6 00	80.5	-15 7			18 010	8.723				
HCEND1	Load	6 00	85 6	-12 9			8 998	4 358				
HCEND2	Load	6 00	86 1	-12 7			8.747	4 236				
Howrah North	Load	6 00	86 9	-12 2			8.235	3.988				
LILD1	Load	6 00	89 6	-9 5			6.533	3 164				
LILD2	Load	6 00	90 5	-9 0			5.521	2.352				
WBSEB (Lilooah)	SWNG	132 00	100 0	0 0								
24 Buses Total					5.900	2 800	95 923	44.748	0.000	0 000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
132WBL1-BRS1			4460.0	1	75	18000	09800	0000850
132WBL2-BRS2			4437 0	1	75	18000	09800	0000850
132WBL3-BRS3			4385 0	1	75	18000	09800	0000850
BRS13-HCEND1			6165 0	1	75	14400	11000	0001000
BRS14-LILD1			2236.0	1	75	.13700	10300	0001490
BRS17-IND2			1643.0	1	75	13700	10300	0001490
BRS1-FSD1			17772.0	1	75	14400	11000	0001000
BRS1-HND1			2908.0	1	75	13700	10300	0001490
BRS2-IND1			1625.0	1	75	.13700	10300	.0001490
BRS6-FSD2			17734.0	1	75	.14400	11000	0001000
BRS8-BALD2			3621.0	1	75	.14400	11000	0001000
BRS9-HCEND2			5069.0	1	75	13700	10300	0001490
BRS9-LILD2			2218.0	1	75	13700	10300	0001490
Cable62			2301.0	1	75	00014	00011	0000001
Cable63			2147.0	1	75	00014	00011	0000001

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol
T4	50.000	132.000	33.000	16.610	27.7	0.000	0.000	0.00
T5	50.000	132.000	33.000	16.610	27.7	0.000	0.000	0.00
T6	50.000	132.000	33.000	16.610	27.7	0.000	0.000	0.00
T9	16.000	33.000	6.000	16.610	29.6	0.000	0.000	0.00
T10	12.500	33.000	6.000	16.620	23.3	0.000	0.000	0.00
T11	12.500	33.000	6.000	16.620	23.3	0.000	0.000	0.00
T12	20.000	33.000	6.000	16.610	31.9	0.000	0.000	0.00
T16	16.000	33.000	6.000	12.200	21.8	0.000	0.000	0.00
T17	16.000	33.000	6.000	16.610	29.6	0.000	0.000	0.00
T18	16.000	33.000	6.000	16.610	29.6	0.000	0.000	0.00
T25	20.000	33.000	6.000	16.610	31.9	0.000	0.000	0.00
T26	20.000	33.000	6.000	16.610	31.9	0.000	0.000	0.00
T27	16.000	33.000	6.000	12.200	21.8	0.000	0.000	0.00
T28	16.000	33.000	6.000	12.200	21.8	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	% Min. Tap	% Max .Tap	% Step	Reg Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		**Connected Bus ID**		**% Impedance (100 MVAb)**			
ID	Type	FromBus	To Bus	R	X	Z	Y
T4	2W XFMR	BRS1	BELUR REC ST	1.20	33.20	33.22	
T5	2W XFMR	BRS2	BELUR REC ST	1.20	33.20	33.22	
T6	2W XFMR	BRS3	BELUR REC ST	1.20	33.20	33.22	
T9	2W XFMR	33HND1	Howrah North	3.50	103.75	103 81	
T10	2W XFMR	33FSD1	FORESHORE	5.70	132.84	132.96	
T11	2W XFMR	33FSD2	FORESHORE	5.70	132.84	132.96	
T12	2W XFMR	BELUR REC ST	6Belur	2.60	83.01	83.05	
T16	2W XFMR	Bus23	LILD2	3.50	76.17	76.25	
T17	2W XFMR	Bus24	HCEND2	3.50	103.75	103.81	
T18	2W XFMR	Bus25	HCEND1	3.50	103.75	103.81	
T25	2W XFMR	BELUR REC ST	6Belur	2.60	83.01	83.05	
T26	2W XFMR	BELUR REC ST	6Belur	2.60	83.01	83.05	
T27	2W XFMR	Bus22	LILD1	3.50	76.17	76.25	
T28	2W XFMR	Bus26	BALD2	3.50	76.17	76.25	
132WBL1-BRS1	Line/Cable	WBSEB (Lillo	BRS1	0.46	0.25	0 52	6 6054382
132WBL2-BRS2	Line/Cable	WBSEB (Lillo	BRS2	0.46	0.25	0.52	6 5713739
132WBL3-BRS3	Line/Cable	WBSEB (Lillo	BRS3	0.45	0.25	0.52	6 4943604
BRS1-FSD1	Line/Cable	BELUR REC ST	33FSD1	23.50	17.95	29.57	1 9353708
BRS1-HND1	Line/Cable	BELUR REC ST	33HND1	3.66	2.75	4.58	0 4718550
BRS2-IND1	Line/Cable	33IND1	BELUR REC ST	2 04	1.54	2.56	0.2636741
BRS6-FSD2	Line/Cable	BELUR REC ST	33FSD2	23.45	17.91	29.51	1 9312326
BRS8-BALD2	Line/Cable	BELUR REC ST	Bus26	4.79	3.66	6.03	0 3943269
BRS9-HCEND2	Line/Cable	BELUR REC ST	Bus24	6.38	4.79	7 98	0 8225010
BRS9-LILD2	Line/Cable	BELUR REC ST	Bus22	2.79	2.10	3.49	0 3598949
BRS13-HCEND1	Line/Cable	BELUR REC ST	Bus25	8.15	6.23	10.26	0 6713685
BRS14-LILD1	Line/Cable	BELUR REC ST	Bus23	2.81	2.11	3 52	0.3628156
BRS17-IND2	Line/Cable	33IND2	BELUR REC ST	2.07	1.55	2.59	0.2665948
Cable62	Line/Cable	BELUR REC ST	33NCG	0.00	0.00	0.00	0 0002506
Cable63	Line/Cable	BELUR REC ST	33NCG	0.00	0.00	0.00	0 0002338
SW1	Tie Switch	33IND1	33IND2				

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R (

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	°o
6Belur	Load	6.000	89 795	-9.9	0.00	0.00	20.02	9 12	0.00	0.00	BELUR REC ST	-6.67	-3 04	785	91 00	
											BELUR REC ST	-6.67	-3.04	785	91.00	
											BELUR REC ST	-6.67	-3.04	785	91 00	
33FSD1	Load	33 000	89 477	-6 4	0 00	0 00	0.00	0 00	0.00	0 00	BELUR REC ST	-9.09	-6 41	217	81.71	
											FORESHORE	9.09	6 41	217	81 71	
33FSD2	Load	33.000	89 483	-6 4	0.00	0.00	0.00	0.00	0.00	0.00	BELUR REC ST	-9.09	-6.42	217	81.70	
											FORESHORE	9.09	6.42	217	81.70	
33HND1	Load	33 000	92.523	-6.2	0 00	0 00	0.00	0 00	0.00	0.00	BELUR REC ST	-8.27	-5.14	184	84 95	
											Howrah North	8.27	5.14	184	84.95	
33IND1	Load	33 000	92.910	-6 2	0 00	0.00	5.92	2.87	0 00	0 00	BELUR REC ST	-2.98	-1.44	62	90.02	
											33IND2	-2.95	-1.43	61	89 99	
33IND2	Load	33 000	92.910	-6.2	0.00	0 00	0.00	0 00	0.00	0.00	BELUR REC ST	-2.95	-1.43	61	89.99	
											33IND1	2.95	1.43	61	89.99	
# 33NCG	Load	33 000	92.997	-6.1	5.90	2.80	-0.01	0.16	0.00	0.00	BELUR REC ST	2 96	1.26	60	91 95	
											BELUR REC ST	3.17	1.36	64	91.95	
BALD2	Load	6 000	85 248	-13 9	0 00	0.00	13.94	5 94	0 00	0 00	Bus26	-13.94	-5.94	1710	92.00	
# BELUR REC ST	Load	33 000	92 997	-6 1	0 00	0 00	0 08	-0.25	0.00	0.00	33FSD1	9 43	5 06	201	88 12	
											33HND1	8 31	4 76	180	86 77	
											33IND1	2.98	1.21	60	92	
											33FSD2	9 43	5 07	201	88 09	
											Bus26	14.20	8.12	307	86 80	
											Bus24	8.87	4 91	190	87 47	
											Bus22	6.57	3 37	138	89 00	
											Bus25	9 15	5 28	198	86 60	
											Bus23	5.55	2.38	113	91 88	
											33IND2	2.95	1 20	59	92 63	
											33NCG	-2.96	-1 26	60	91 95	
											33NCG	-3.17	-1 36	64	91 95	
											BRS1	-30.54	-16 38	652	88 12	
											BRS2	-30.54	-16 38	652	88 12	
											BRS3	-30.55	-16 39	652	88 12	
											6Belur	6.69	3 59	142	88 09	
											6Belur	6.69	3 59	142	88 09	
											6Belur	6 69	3.59	142	88.09	
BRS1	Load	132 000	99 814	0.0	0.00	0 00	0.00	0 00	0 00	0.00	WBSEB (Lillo	-30 71	-20.99	163	82	
											BELUR REC ST	30.71	20.99	163	82.55	

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
BRS2	Load	132 000	99.815	0 0	0 00	0 00	0 00	0.00	0 00	0 00	WBSEB (Lillo	-30.71	-21.00	163	82.55	
											BELUR REC ST	30.71	21 00	163	82.55	
BRS3	Load	132 000	99 817	0 0	0 00	0 00	0.00	0 00	0 00	0 00	WBSEB (Lillo	-30.71	-21 00	163	82.54	
											BELUR REC ST	30.71	21.00	163	82 54	
Bus22	Load	33 000	92.721	-6 2	0 00	0 00	0 00	0 00	0 00	0 00	BELUR REC ST	-6.56	-3.66	141	87 29	
											LILD1	6.56	3 66	141	87.29	
Bus23	Load	33 000	92.772	-6 2	0 00	0.00	0 00	0.00	0 00	0 00	BELUR REC ST	-5.54	-2 69	116	89.96	
											LILD2	5.54	2.69	116	89.96	
Bus24	Load	33.000	92.117	-6.2	0 00	0.00	0.00	0 00	0.00	0.00	BELUR REC ST	-8.79	-5.56	197	84	
											HCEND2	8.79	5.56	197	84.52	
Bus25	Load	33 000	91.822	-6 2	0 00	0 00	0.00	0 00	0 00	0.00	BELUR REC ST	-9.05	-5.78	204	84.29	
											HCEND1	9.05	5.78	204	84.29	
Bus26	Load	33 000	91 940	-6 2	0.00	0 00	0 00	0 00	0 00	0 00	BELUR REC ST	-14 05	-8.34	310	85.98	
											BALD2	14.05	8.34	310	85.98	
FORESHORE	Load	6 000	80.448	-15.7	0 00	0 00	18.01	8.72	0 00	0.00	33FSD1	-9.00	-4 36	1196	90.00	
											33FSD2	-9.01	-4 36	1196	90.00	
HCEND1	Load	6 000	85.537	-12 9	0.00	0.00	9 00	4 36	0 00	0 00	Bus25	-9.00	-4 36	1124	90.00	
HCEND2	Load	6 000	86.069	-12 7	0 00	0 00	8 75	4 24	0 00	0 00	Bus24	-8.75	-4 24	1086	90 00	
Howrah North	Load	6 000	86.925	-12.2	0 00	0 00	8 23	3 99	0 00	0.00	33HND1	-8.23	-3.99	1012	90.00	
LILD1	Load	6 000	89 617	-9 5	0 00	0 00	6 53	3 16	0 00	0 00	Bus22	-6.53	-3 16	779	90.00	
LILD2	Load	6 000	90 466	-9 0	0 00	0.00	5 52	2 35	0 00	0 00	Bus23	-5.52	-2.35	638	92.00	
* WBSEB (Lillo	Swng	132 000	100 000	0 0	92.31	43 45	0 00	0 00	0 00	0 00	BRS1	30.77	14 43	148	90 54	
											BRS2	30.77	14 47	148	90 49	
											BRS3	30.77	14 55	148	90.40	

- A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
* 6Belur	6 000	89.795	5.388	* 33FSD1	33.000	89 477	29.528	* 33FSD2	33.000	89.483	29 529
* 33HND1	33.000	92.523	30.533	* 33IND1	33.000	92.910	30.660	* 33IND2	33.000	92.910	30 660
* 33NCG	33.000	92.997	30.689	* BALD2	6.000	85.248	5 115	* BELUR REC ST	33.000	92.997	30 689
* Bus22	33.000	92.721	30.598	* Bus23	33.000	92.772	30.615	* Bus24	33.000	92.117	30 399
* Bus25	33 000	91.822	30 301	* Bus26	33.000	91.940	30.340	* FORESHORE	6.000	80.448	4 827
* HCEND1	6.000	85.537	5.132	* HCEND2	6.000	86.069	5.164	* Howrah North	6.000	86.925	5 215
* LILD1	6.000	89.617	5.377	* LILD2	6.000	90.466	5.428				

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 107 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit
# indicates bus voltages violate marginal limit

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T4	Transformer				50.000	37.200	74.40	34.660	69.32
T5	Transformer				50.000	37.202	74 40	34.661	69.32
T6	Transformer				50 000	37.207	74.41	34.665	69.33
T9	Transformer				16.000	9.739	60.87	9.150	57.19
T10	Transformer				12.500	11.127	89.01	10.004	80.03
T11	Transformer				12.500	11.131	89.05	10.007	80.06
T12	Transformer				20.000	7.594	37.97	7.332	36.66
T16	Transformer				16.000	6.154	38.46	6.001	37.51
T17	Transformer				16.000	10.402	65.01	9.719	60.74
T18	Transformer				16.000	10.733	67.08	9.998	62.49
T25	Transformer				20.000	7.594	37.97	7.332	36.66
T26	Transformer				20.000	7.594	37.97	7.332	36.66
T27	Transformer				16.000	7.510	46.94	7.259	45.37
T28	Transformer				16.000	16.340	102.13	15.151	94.69

Project:
Location:
Contract:
Engineer:
Filename. Belur132kV

PowerStation
3.0.1C

Study Case: **LF**

Date: 01-18-2002
SN: TATAENERGY
Revision: Base
Config.: Normal

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage	
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To
T12	6Belur	BELUR REC ST	-6.7	-3.0	6.7	3.6	17.3	553.5	89.8	93.0
T25	6Belur	BELUR REC ST	-6.7	-3.0	6.7	3.6	17.3	553.5	89.8	93.0
T26	6Belur	BELUR REC ST	-6.7	-3.0	6.7	3.6	17.3	553.5	89.8	93.0
BRS1-FSD1	33FSD1	BELUR REC ST	-9.1	-6.4	9.4	5.1	336.0	-1355.0	89.5	93.0
T10	33FSD1	FORESHORE	9.1	6.4	-9.0	-4.4	88.2	2054.2	89.5	80.4
BRS6-FSD2	33FSD2	BELUR REC ST	-9.1	-6.4	9.4	5.1	335.5	-1352.0	89.5	93.0
T11	33FSD2	FORESHORE	9.1	6.4	-9.0	-4.4	88.2	2055.5	89.5	80.4
BRS1-HND1	33HND1	BELUR REC ST	-8.3	-5.1	8.3	4.8	39.7	-376.2	92.5	93.0
T9	33HND1	Howrah North	8.3	5.1	-8.2	-4.0	38.8	1149.6	92.5	86.[illegible]
BRS2-IND1	33IND1	BELUR REC ST	-3.0	-1.4	3.0	1.2	2.5	-225.9	92.9	93.0
BRS17-IND2	33IND2	BELUR REC ST	-2.9	-1.4	2.9	1.2	2.5	-228.5	92.9	93.0
Cable62	33NCG	BELUR REC ST	3.0	1.3	-3.0	-1.3	0.0	-0.2	93.0	93.0
Cable63	33NCG	BELUR REC ST	3.2	1.4	-3.2	-1.4	0.0	-0.2	93.0	93.0
T28	BALD2	Bus26	-13.9	-5.9	14.0	8.3	110.5	2406.0	85.2	91.9
BRS8-BALD2	BELUR REC ST	Bus26	14.2	8.1	-14.0	-8.3	149.7	-222.8	93.0	91.9
BRS9-HCEND2	BELUR REC ST	Bus24	8.9	4.9	-8.8	-5.6	78.5	-645.6	93.0	92.1
BRS9-LILD2	BELUR REC ST	Bus22	6.6	3.4	-6.6	-3.7	17.9	-296.8	93.0	92.7
BRS13-HCEND1	BELUR REC ST	Bus25	9.2	5.3	-9.0	-5.8	108.3	-490.6	93.0	91.8
BRS14-LILD1	BELUR REC ST	Bus23	5.5	2.4	-5.5	-2.7	12.1	-303.9	93.0	92.8
T4	BELUR REC ST	BRS1	-30.5	-16.4	30.7	21.0	166.7	4611.3	93.0	99.8
T5	BELUR REC ST	BRS2	-30.5	-16.4	30.7	21.0	166.7	4611.8	93.0	99.8
T6	BELUR REC ST	BRS3	-30.5	-16.4	30.7	21.0	166.7	4612.8	93.0	99.8
132WBL1-BRS1	BRS1	WBSEB (Lillo	-30.7	-21.0	30.8	14.4	58.1	-6561.5	99.8	100.0
132WBL2-BRS2	BRS2	WBSEB (Lillo	-30.7	-21.0	30.8	14.5	57.8	-6527.7	99.8	100.0
132WBL3-BRS3	BRS3	WBSEB (Lillo	-30.7	-21.0	30.8	14.6	57.2	-6451.3	99.8	100
T27	Bus22	LILD1	6.6	3.7	-6.5	-3.2	22.9	499.8	92.7	89.6
T16	Bus23	LILD2	5.5	2.7	-5.5	-2.4	15.4	335.2	92.8	90.5
T17	Bus24	HCEND2	8.8	5.6	-8.7	-4.2	44.6	1323.0	92.1	86.1
T18	Bus25	HCEND1	9.0	5.8	-9.0	-4.4	47.8	1417.5	91.8	85.5
							2264.4	1698.6		

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION . LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es).	92.306	43.453	102.022	90.48 Lagging
Generators:	5.900	2.800	6.531	90.34 Lagging
Total Demand:	98.206	46.253	108.553	90.47 Lagging
Total Motor Load:	95.995	44.655	105.873	90.67 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	2.211	1.598		
System Mismatch:	0.098	0.413		

Number of Iterations· 30

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	12	13

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	8	0	0	7	0	0	15

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.000100 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename: CESC1

Output Filename: C:\ETAPS\PowerStn\Park Lane-132kV\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Auckland	Load	6.00	100.0	0.0			12.409	6.010				
Bus6	Load	33.00	100.0	0.0								
Bus7	Load	33.00	100.0	0.0								
Bus9	Load	33.00	100.0	0.0								
Bus10	Load	33.00	100.0	0.0								
Bus12	Load	33.00	100.0	0.0								
Bus13	Load	33.00	100.0	0.0								
Majerhat	SWNG	132.00	100.0	0.0								
Marquis St	Load	6.00	100.0	0.0			9.763	5.269				
ParkCircle	Load	6.00	100.0	0.0			9.948	5.370				
ParkLane	Load	132.00	100.0	0.0								
PARK LANE	Load	33.00	100.0	0.0								
P Lane	Load	6.00	100.0	0.0			19.339	10.438				
13 Buses Total					0.000	0.000	51.459	27.087	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
33PLN10-MARD1			1019 0	1	75	13700	10300	0001490
33PLN3-PLND2			140.0	1	75	09000	10000	0000942
33PLN4-PCRID1			1903.0	1	75	13700	10300	0001490
33PLN6-ASQD1			1367.0	1	75	13300	12000	0000720
33PLN7-PLND1			140.0	1	75	.09000	10000	0000942
33PLN9-ASQD2			1332.0	1	75	13300	.12000	0000720
MAJ1PLN1			7414 0	1	75	07980	.14000	0000439

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	75.000	132.000	33.000	16.600	44.3	0.000	0.000	0.00
T2	75.000	132.000	33.000	16.600	44.3	0.000	0.000	0.00
T3	16.000	33.000	6.000	12.200	21.8	0.000	0.000	0.00
T4	16.000	33.000	6.000	12.200	21.8	0.000	0.000	0.00
T5	20.000	33.000	6.000	12.200	23.5	0.000	0.000	0.00
T6	20.000	33.000	6.000	12.200	23.5	0.000	0.000	0.00
T7	16.000	33.000	6.000	12.200	21.8	0.000	0.000	0.00
T8	15.000	33.000	6.000	11.400	19.0	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim Bus ID	Sec Bus ID	Ter Bus ID	% Min Tap	% Max Tap	% Step	Reg Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	ParkLane	PARK LANE	0.50	22.13	22.13	
T2	2W XFMR	ParkLane	PARK LANE	0.50	22.13	22.13	
T3	2W XFMR	Bus6	P Lane	3.49	76.17	76.25	
T4	2W XFMR	Bus7	P Lane	3.49	76.17	76.25	
T5	2W XFMR	Bus9	Auckland	2.60	60.94	61 00	
T6	2W XFMR	Bus10	Auckland	2.60	60.94	61.00	
T7	2W XFMR	Bus12	ParkCircle	3.49	76.17	76.25	
T8	2W XFMR	Bus13	Marquis St	3.99	75.89	76.00	
33PLN3-PLND2	Line/Cable	PARK LANE	Bus6	0.12	0.13	0.17	0.0143617
33PLN4-PCRID	Line/Cable	PARK LANE	Bus12	2.39	1.80	3.00	0 3087827
33PLN6-ASQD1	Line/Cable	PARK LANE	Bus9	1.67	1.51	2.25	0 1071837
33PLN7-PLND1	Line/Cable	PARK LANE	Bus7	0.12	0.13	0.17	0 0143617
33PLN9-ASQD2	Line/Cable	PARK LANE	Bus10	1.63	1.47	2.19	0 1044395
33PLN10-MARD	Line/Cable	PARK LANE	Bus13	1.28	0.96	1.60	0 1653440
MAJ1PLN1	Line/Cable	Majerhat	ParkLane	0.34	0.60	0.69	5 6710696

EQUIPMENT CABLE Input Data

Cable	**Connection**			**ohms / 1000 m per Conductor**								**(H(**
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R (

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Auckland	Load	6 000	5 596	-5 9	0 00	0 00	12.41	6 01	0 00	0 00	Bus9	-6.20	-3.00	711	90.01	
											Bus10	-6.21	-3.01	711	89 99	
Bus6	Load	33 000	31 554	-3 5	0.00	0 00	0 00	0 00	0 00	0 00	PARK LANE	-9 72	-6 34	212	83 75	
											P Lane	9 72	6 34	212	83 75	
Bus7	Load	33 000	31.554	-3 5	0 00	0 00	0 00	0.00	0 00	0 00	PARK LANE	-9.72	-6.34	212	83 75	
											P Lane	9.72	6.34	212	83.75	
Bus9	Load	33 000	31.508	-3 5	0 00	0 00	0 00	0 00	0 00	0 00	PARK LANE	-6.22	-3.33	129	88 13	
											Auckland	6.22	3 33	129	88.12	
Bus10	Load	33 000	31 509	-3 5	0 00	0 00	0 00	0 00	0 00	0 00	PARK LANE	-6.22	-3 34	129	88.10	
											Auckland	6.22	3.34	129	88 09	
Bus12	Load	33 000	31 438	-3 5	0 00	0 00	0 00	0 00	0 00	0 00	PARK LANE	-10.00	-6.57	219	83 58	
											ParkCircle	10.00	6 57	219	83 58	
Bus13	Load	33 000	31 496	-3 5	0 00	0 00	0.00	0 00	0 00	0 00	PARK LANE	-9 82	-6 42	215	83.72	
											Marquis St	9 82	6 42	215	83 72	
* Majerhat	Swng	132 000	132.000	0 0	52 02	30 80	0 00	0 00	0.00	0 00	ParkLane	52.02	30 80	264	86 5	
Marquis St	Load	6 000	5 415	-8 3	0 00	0 00	9 76	5.27	0 00	0 00	Bus13	-9.76	-5 27	1182	88 00	
ParkCircle	Load	6 000	5 399	-8 5	0 00	0 00	9 95	5 37	0 00	0 00	Bus12	-9 95	-5 37	1208	88 00	
ParkLane	Load	132 000	131 503	-0 1	0 00	0 00	0 00	0 00	0 00	0 00	Majerhat	-51.89	-36 22	277	82 00	
											PARK LANE	25.95	18 11	138	82 00	
											PARK LANE	25.95	18 11	138	82.00	
PARK LANE	Load	33 000	31 561	-3 5	0 00	0 00	-0 01	0 00	0 00	0 00	Bus6	9.72	6 33	212	83 80	
											Bus12	10.04	6 32	217	84 64	
											Bus9	6.23	3 25	128	88.68	
											Bus7	9 72	6 33	212	83 80	
											Bus10	6.23	3 25	128	88 64	
											Bus13	9 84	6 28	213	84 30	
											ParkLane	-25 90	-15 88	555	85 25	
											ParkLane	-25 90	-15 88	555	85 25	
P Lane	Load	6 000	5 431	-8 3	0 00	0 00	19 34	10 44	0 00	0 00	Bus6	-9 67	-5 22	1168	88 00	
											Bus7	-9.67	-5 22	1168	88 00	

* A regulate (constant kV) bus

# The flagged bus has a load mismatch of more than 0 1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 90 % - Marginal Limit = 85 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltage**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
* ParkCircle	6.000	89.979	5.399								

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 110 % - Marginal Limit = 120 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltag**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				75.000	31.643	42.19	30 377	40 50
T2	Transformer				75.000	31.643	42.19	30.377	40.50
T3	Transformer				16.000	11.606	72.54	10 988	68 67
T4	Transformer				16.000	11.606	72.54	10.988	68.67
T5	Transformer				20.000	7.056	35.28	6.892	34.46
T6	Transformer				20.000	7.061	35.30	6.896	34 48
T7	Transformer				16.000	11.969	74.81	11 305	70 66
T8	Transformer				15 000	11.733	78.22	11.094	73 96

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	
T5	Auckland	Bus9	-6.2	-3.0	6.2	3.3	14.2	332.8	93.3	95.5	
T6	Auckland	Bus10	-6.2	-3.0	6.2	3.3	14.2	333.2	93.3	95.5	
33PLN3-PLND2	Bus6	PARK LANE	-9.7	-6.3	9.7	6.3	1.7	-11.2	95.6	95.6	
T3	Bus6	P Lane	9.7	6.3	-9.7	-5.2	51.5	1122.3	95.6	90.5	
33PLN7-PLND1	Bus7	PARK LANE	-9.7	-6.3	9.7	6.3	1.7	-11.2	95.6	95.6	
T4	Bus7	P Lane	9.7	6.3	-9.7	-5.2	51.5	1122.3	95.6	90.5	
33PLN6-ASQD1	Bus9	PARK LANE	-6.2	-3.3	6.2	3.2	9.1	-89.7	95.5	95.6	
33PLN9-ASQD2	Bus10	PARK LANE	-6.2	-3.3	6.2	3.3	8.8	-87.4	95.5	95.6	
33PLN4-PCRID	Bus12	PARK LANE	-10.0	-6.6	10.0	6.3	37.3	-253.3	95.3	95.6	
T7	Bus12	ParkCircle	10.0	6.6	-9.9	-5.4	55.2	1202.4	95.3	90.0	
33PLN10-MARC	Bus13	PARK LANE	-9.8	-6.4	9.8	6.3	19.2	-136.5	95.4	95.6	
T8	Bus13	Marquis St	9.8	6.4	-9.8	-5.3	60.4	1146.9	95.4	90.2	
MAJ1PLN1	Majerhat	ParkLane	52.0	30.8	-51.9	-36.2	130.3	-5421.1	100.0	99.6	
T1	ParkLane	PARK LANE	25.9	18.1	-25.9	-15.9	50.4	2232.4	99.6	95.6	
T2	ParkLane	PARK LANE	25.9	18.1	-25.9	-15.9	50.4	2232.4	99.6	95.6	
							555.9	3714.2			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	52.024	30.800	60.458	86.05 Lagging
Generators:	000	0.000	0.000	100.00 Lagging
Total Demand.	52.024	30.800	60.458	86.05 Lagging
Total Motor Load:	51.454	27.087	58.148	88.49 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.570	3.714		
System Mismatch:	0.008	0.004		

Number of Iterations. 4

Annex 12

Energy Flow Details of 6 kV Feeders

Feeder: L/C At Ganguly Bagan T/H
Jadavpur D/S

			Initial Reading (5/5/2001)				Final Reading (28/6/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
	Rating (kVA)	Time	MF	Meter Reading Phase A	Phase B	Phase C	Time	Meter Reading Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading			800			239617	09 20			241507			1890	1512000	1260000
Distribution Transformers															
1 Ganguly Bagan O/T	315	14 25	60	343 7	434 5	375 5	10 01	887	1084	1089	543	650	714	114378	95315
2 Gouranga Mandir T/H	315	14.22	60	334 9	301	263 4	10 00	841	794	711	506	493	448	86802	72335
3 Gouranga Mandir O/T F1	200	14 20	60	427 5	357 2	525 4	09 44	1114	918	1380	687	561	855	126114	105095
4 Ganguly Bagan T/H F1	315	14 31	60	638 2	541 6	482	10 20	1848	1575	1432	1210	1033	950	191592	159660
5 Ramgarh O/T F1	315	14 29	60	642 5	406	661 7	10 15	1995	1576	2172	1353	1170	1510	241968	201640
6 Ganguly Bagan P/T F1	300	14 34	60	787 3	815 5	793 6	10 05	2245	2328	2278	1458	1513	1484	267270	222725
7 Garia T/H F1	315	14 35	60	694 8	679 1	720 6	10 36	1457	1450	1613	762	771	892	145530	121275
8 Garia (N) O/T F1	300	14 37	60	508 1	499 5	562	10 30	2108	2092	2302	1600	1593	1740	295944	246620
													Total (b)	1469598	1224665
Energy loss in the 6 kV feeder and transformers															35335 **2.8%**

Note.
For Ganguly Bagan P/T F1, Phase C consumption has been assumed an average of Ph A & B

Summary of energy audit result

Input to the 6 kV feeder	(kWh)	1260000
Output energy recorded	(kWh)	1224665
Total enegy loss	(kWh)	35335
Percentage loss	(%)	**2.8%**

Summary of Load Flow result

Swing Bus	(MW)	1 789
Generators	(MW)	0 000
Total operating Load	(MW)	1 702
Peak losses	(MW)	0 087
Iron Loss of transformers	(MW)	0 005
Study period		45
LLF		0 56
Energy loss (Technical)	(kWh)	58018
	(%)	**4.6%**
Energy Loss (Non-technical)	(kWh)	-22683
	(%)	**-1.8%**

Feeder: Akra Clony T/H
Akra D/S

	Rating	Initial Reading (15/5/2001)					Final Reading (27/6/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading		10 45	1 3			33039	13 15			33519			480	624000	653023
Distribution Transformers															
1 Akra Colony T/H	315	10 40	60	2711	2331	3006	13 17	3706	3221	4166	995	890	1160	182748	191248
2 Akra Colony O/T	315	10 40	60	1243	4135	4066	13 23	2471	5571	5531	1228	1435	1465	247698	259219
3 Akra Saktigarh Colony P/T	315	10 40	60	2018	2199	2239	13 30	2947	3172	3234	929	974	995	173838	181923
													Sub-total	604284	632390
															20633
Energy loss in the 6 kV feeder and transformers															**3.2%**

Summary of energy audit result		
Input to the 6 kV feeder	(kWh)	653023
Output energy recorded	(kWh)	632390
Total enegy loss	(kWh)	20633
Percentage loss	(%)	**3.2%**
Summary of Load Flow result		
Swing Bus	(MW)	0 749
Generators	(MW)	0 000
Total operating Load	(MW)	0 734
Peak losses	(MW)	0 016
Iron Loss of transformers	(MW)	0 002
Study period		45
LLF		0 48
Energy loss (Technical)	(kWh)	10400
	(%)	**1.6%**
Energy Loss (Non-technical)	(kWh)	10233
	(%)	**1.6%**

Feeder: Chandalpara S/H1/Sree Hanuman J.M
Belur D/S

			Initial Reading (26/6/2001)					Final Reading (26/7/2001)				Energy Advance			Total kWh	Modified Total kWh
					Meter Reading				Meter Reading							
		Rating (kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading			11 00	800			74995				76432			1437	1149600	
Distribution Transformers																
1	C L. Missir Rd (E) T/H	315	12 10	60	1342	1442	1349	14 50	1509	1626	1503	167	184	154	30300	16160
2	C L. Missir Rd T/H F1-3	570	12 00	60	1812	1924	1782	14 55	1813	2782	2586	831	859	804	149625	79800
3	C L Missir Rd T/H F2		12 02	100	1366	1483	1353	15 00	1967	2131	1981	601	648	628	187740	100128
4	K D Jalan Rd T/H No 2 F3		10 10	80	410	381	339		597	582	542	187	201	203	47320	25237
5	K D Jalan Rd T/H No 1 F1		10 12	60	1381	556	1517		1617	770	1754	236	214	237	41226	21987
6	K D. Jalan Rd T/H No 1 F2		11 45	60	707	589	482		821	682	559	114	93	77	17106	9123
														Sub-total		*252436*
HT Consumers																
1	Arham Petro Products		12 18	1			835706				967999			132293		132293
2	Shyam Steel Industries		12 30	4			219198				287614			273664		145954
3	Cal Tubes & Structures		12 35	2			101588				126986			50796		27091
4	Sree Durga Rolling Mill		12 50	1			60908				112736			51828		27642
5	Sree Hanuman J M		11 30	6			631710				713740			492180		492180
														Sub-total		*825160*
Energy loss in the 6 kV feeder and transformers															72004 **6.3%**	

Remarks :The consumptions of all the nodes for which the modified unit is shown in green have been apportioned for 16 days instead of 30 days since they were fed from a different feeder from 13/7/2001 to 26/7/2001.

Summary of energy audit result		
Input to the 6 kV feeder	(kWh)	1149600
Output energy recorded	(kWh)	1077596
Total enegy loss	(kWh)	72004
Percentage loss	(%)	**6.3%**
Summary of Load Flow result		
Swing Bus	(MW)	4 367
Generators	(MW)	0 000
Total operating Load	(MW)	4 102
Peak losses	(MW)	0 265
Iron Loss of transformers	(MW)	0 004
Study period		16
LLF		0 5
Energy loss (Technical)	(kWh)	52550
	(%)	**4.6%**
Energy Loss (Non-technical)	(kWh)	19454
	(%)	**1.7%**

Feeder: J.N. Mukherjee Road T/H No. 1
Belur D/S

	Rating	Initial Reading (26/6/2001)					Final Reading (26/7/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading		11 00	400			131710	12 55			133653			1943	777200	1165800
Distribution Transformers															
1 J N Mukherjee Rd T/H No 1	315	11 22	100	114	101	105	14 50	609	571	594	495	470	489	145370	218055
2 Salkia (E) T/H	300	12 22	60	4315	3366	3826	14 55	4812	3752	4245	497	386	419	78120	117180
3 J N Mukherjee Rd (S) P/T F-1	315	12 25	60	2875	2978	2682	15 00	3295	3508	3216	420	530	534	89064	133596
4 S N Temple Rd P/T F-1	400	11 40	60	2725	2676	2796	15 05	3221	3241	3347	496	565	551	96720	145080
													Sub-total	409274	613911
HT Consumers															
1 Sree Vijoy Lakshmi R M		11 25	1			461861				530519			68658	68658	102987
2 Salkia J P		12 10	1			181152				189466			8314	8314	12471
3 Hanuman J P		12 05	1			159806				220215			60409	60409	90614
4 Rames Kumar & Co		11 50	0 4			286179				307048			20869	8348	12521
5 OM Development		11 55	2			380652				470611			89959	179918	269877
6 Bandhaghat J P		11 58	0 4			855959				866190			10231	4092	6138 6
													Sub-total	329739	494609
Energy loss in the 6 kV feeder and transformers															57281
															4.9%

Summary of energy audit result

Input to the 6 kV feeder	(kWh)	1165800
Output energy recorded	(kWh)	1108520
Total enegy loss	(kWh)	57281
Percentage loss	(%)	**4.9%**

Summary of Load Flow result

Swing Bus	(MW)	2 472
Generators	(MW)	0 000
Total operating Load	(MW)	2 350
Peak losses	(MW)	0 122
Iron Loss of transformers	(MW)	0 003
Study period		45
LLF		0 63
Energy loss (Technical)	(kWh)	85817
	(%)	**7.4%**
Energy Loss (Non-technical)	(kWh)	-28536
	(%)	**-2.4%**

Feeder: Sree Ambica J.M/British India R.M
Belur D/S

	Rating	Initial Reading (26/6/2001)					Final Reading (26/7/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading		11 05	800			60881	12 55			61452			571	456800	685200
Distribution Transformers															
1 Girish Ghosh Rd (N) O/T	400	11 10	60	2168	2200	2441	14 50	2541	2569	2850	373	369	409	69072	103608
2 Girish Ghosh Rd (N) O/T F1	315	11 05	60	1796	1463	490	14 55	2102	1746	809	306	283	319	54492	81738
													Sub-total	123564	185346
HT Consumers															
1 Sree Ambica Jute Mill		10 40	6			105233	13 03			142819			37586	225518	338278
2 Sree Bajrang Iron Industries		10 50	1			169244	13 48			265603			96359	96359	144539
													Sub-total	321877	482816
Energy loss in the 6 kV feeder and transformers															17038
															2.5%

Summary of energy audit result

Input to the 6 kV feeder	(kWh)	685200
Output energy recorded	(kWh)	668162
Total enegy loss	(kWh)	17038
Percentage loss	(%)	**2.5%**

Summary of Load Flow result

Swing Bus	(MW)	2 727
Generators	(MW)	0 000
Total operating Load	(MW)	2 677
Peak losses	(MW)	0 050
Iron Loss of transformers	(MW)	0 002
Study period		45
LLF		0 5
Energy loss (Technical)	(kWh)	28674
	(%)	**4.2%**
Energy Loss (Non-technical)	(kWh)	-11636
	(%)	**-1.7%**

Feeder: Howrah Auto Telephone Exchange (NS)
Howrah Central D/S

	Rating	Initial Reading (29/5/2001)					Final Reading (26/6/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading		05 55	800			31282	01 00			31897			615.2352	492188	791017
				Meter running slow				Meter running slow							
Distribution Transformers															
1 Howrah Road O/T F-1	315	11 55	60	752	441	597	12 45	1048	632	818	296	191	221	42516	68329
2 Howrah Road (S) T/H	300	12 00	60	1748	2307	2026	12 50	2104	2747	2423	356	440	397	71538	114972
3 Golaban O/T	315	11 15	60	383	102	161	12 40	457	128	196	74	26	35	8058	12950
													Sub-total	122112	196251
HT Consumers															
1 How Auto Tele Exch (NS)			1			955572				972438			16866	16866	27106
2 Eastern Rly Kings Rd			2			224850	13 40			390585			165735	331470	532720
3 Reyrolle Burn			1			60704	13 10			64602			3898	3898	6265
													Sub-total	352234	566090
Energy loss in the 6 kV feeder and transformers															28675 **3.6%**

Note
From mid-term to final

Summary of energy audit result

Input to the 6 kV feeder	(kWh)	791017
Output energy recorded	(kWh)	762342
Total enegy loss	(kWh)	28675
Percentage loss	(%)	**3.6%**

Summary of Load Flow result

Swing Bus	(MW)	1 632
Generators	(MW)	0 000
Total operating Load	(MW)	1 608
Peak losses	(MW)	0 028
Iron Loss of transformers	(MW)	0 002
Study period		45
LLF		0 74
Energy loss (Technical)	(kWh)	25024
	(%)	**3.2%**
Energy Loss (Non-technical)	(kWh)	3651
	(%)	**0.5%**

Feeder: Sarvamangala Prop/Canning St. (W) P/T
Jackson Lane D/S

	Rating	Initial Reading (5/5/2001)					Final Reading (25/6/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading			800			24922				26028			1106	885120	780988
Distribution Transformers															
1 Canning St (W) P/T	315	10 05	60	930	866	785	09 10	1440	1352	1226	510	487	441	86286	76135
2 Strand Rd (S) P/T	315	10 36	60	362 3	333	403	09 15	914	865	994	551	533	592	100524	88698
3 Strand Rd T/H	400	10 40	60	585	692	721	09 30	1332	1693	1686	747	1001	965✓	162828	143672
4 Clive Row (E) T/H F1	400	10 10	60	99	113	113	10 00	273	313	299	174	200	186	33606	29652
5 Clive Row (E) T/H F2		10 12	60	182	234	221	10 01	535	712	667	352	478	446	76608	67595
6 Clive Row T/H F1	400	10 17	80	15080	14109	13413	10 10	15723	14294	13591	643	185	178	80480	71012
7 Clive Row T/H F2		10 18	80	144	132	120	10 30	664	626	568	520	494	449	117032	103264
													Sub-total	657364	580027
HT Consumers															
1 Sarvamangala Properties		10 41	1			634344	09 50			694338			59994	59994	52936
2 Jessop & Co Office		10 21	1			437053	09 25			446925			9872	9872	8711
3 Model Manufacturing		10 31	1			958263	09 45			1029626			71363	71363	62967
4 Jardine Handerson		11 00	1			3856	10 00			42608			38752	38752	34193
5 Chartered Bank No 2		10 23	1		Ask them	27778 8	10 15			33506 7			5728	5728	5054
													Sub-total	185709	163861
Energy loss in the 6 kV feeder and transformers															37100
															4.8%

Summary of energy audit result		
Input to the 6 kV feeder	(kWh)	780988
Output energy recorded	(kWh)	743888
Total enegy loss	(kWh)	37100
Percentage loss	(%)	4.8%
Summary of Load Flow result		
Swing Bus	(MW)	2 245
Generators	(MW)	0 000
Total operating Load	(MW)	2 207
Peak losses	(MW)	0 039
Iron Loss of transformers	(MW)	0 006
Study period		45
LLF		0 31
Energy loss (Technical)	(kWh)	19321
	(%)	2.5%
Energy Loss (Non-technical)	(kWh)	17779
	(%)	2.3%

Feeder: Park Street (W) T/H
Park Lane D/S

	Rating (kVA)	Initial Reading (5/5/2001)					Final Reading (25/6/2001)				Energy Advance			Total kWh
				Meter Reading				Meter Reading						
		Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C	
Sending end reading		10 20	400			62720				65603			2883	1153200
Distribution Transformers														
1 Park St (W) T/H F1	600	10 32	60	821	750	918		2130	1942	2340	1309	1192	1422	235434
2 Park St (W) T/H F2	315	10 31	60	254	259	226		642	554	553	388	295	327	60594
3 Middleton Row (N) T/H F1	315	10 42	60	376	308	483		855	932	711	480	624	229	79962
4 Middleton Row T/H	315	10 33	60	348	408	286		908	727	1151	559	319	865	104604
5 Camac Street P/T	300	10 50	80	1	1	1		126	112	65	125	111	64	23944
													Sub-total	*504538*
HT Consumers														
1 Somenath Estates		10 26	1			538668	09 50			723466			184798	184798
2 Sterling Const Corpn.			1 / did they get this reading			222796	09 25			301201			78405	78405
3 Apsara Cooperative H Society		10 29	1			731979	09 45			828418			96439	96439
4 Continental Housing Corpn		10 18	1			882836	10 00			965263			82427	82427
5 Abloom		10·23	1			536934	10 15			719322			182388	182388
													Sub-total	*624457*

Energy loss in the 6 kV feeder and transformers

Summary of energy audit result		
Input to the 6 kV feeder	(kWh)	1017529
Output energy recorded	(kWh)	996172
Total enegy loss	(kWh)	21357
Percentage loss	(%)	**2.1%**
Summary of Load Flow result		
Swing Bus	(MW)	2 305
Generators	(MW)	0 000
Total operating Load	(MW)	2 262
Peak losses	(MW)	0 043
Iron Loss of transformers	(MW)	0 005
Study period		45
LLF		0 46
Energy loss (Technical)	(kWh)	26708
	(%)	**2.6%**
Energy Loss (Non-technical)	(kWh)	-5351
	(%)	**-0.5%**

Feeder: 3 Way L/C No. 1 At D/S
Hide Road D/S

	Rating	Initial Reading (19/5/2001)					Final Reading (27/6/2001)				Energy Advance			Total kWh
	(kVA)	Time	MF	Meter Reading			Time	Meter Reading			Phase A	Phase B	Phase C	
				Phase A	Phase B	Phase C		Phase A	Phase B	Phase C				
Sending end reading		10 55	800			201242	11 05			202145			903	722400
Distribution Transformers														
1 SRS T/H No3		11 55	100	1	1	1		1	1	1	0 30	0 30	0 30	90
2 Hide Road (S) O/T	315	11 05	60	1382	1393	1891		1880	1925	2541	498	532	650	100794
3 Sonapur T/H F1	200	11 05	60	469	467	496	12 47	647	612	688	178	145	192	30900
4 Brace Bridge (W) T/H	200	11 25	60	708	724	576	11 50	843	898	700	135	174	124	25992
5 Hide Road T/H No1	200	11 10	60	11	13	23	11 42	18	22	39	7	9	16	1932
6 Hide Road T/H No2	200	11 10	60	338	254	370	11 40	653	536	646	315	282	276	52362
													Sub-total	212070
HT Consumers														
1 Central Warehousing Corpn		11 17	1			257564	13 30			263549			5985	5985
2 Indian Oil Blending		11 11	1			543415	13 20			633175			89760	89760
3 Siemens Engg & Mfg Co		11 42	1			305727	12 35			308825			3098	3098
4 Indian Records Mfg		11 34	1			835041	12 40			875214			40173	40173
5 BIECCO Lawne		12 18	1			140430	11 32			263352			122922	122922
6 Stewarts & Lloyds No 1		11 38	1			127424	11 20			145390			17966	17966
7 P C Wagon Repair Shop		11 24	1			572882	12 56			599712			26830	26830
8 Glaxo		11 20	1			604860	12 20			625612			20752	20752
9 Lipton		11 57	1			266317	12 25			275986			9669	9669
10 Balmer Lawne No 2		11 17	2			681546	12 10			736305			54759	109518
11 Avery		11 25	1			134562	11 35			158142			23580	23580
														470253
Energy loss in the 6 kV feeder and transformers														

Summary of energy audit result

Input to the 6 kV feeder	(kWh)	833538
Output energy recorded	(kWh)	787296
Total enegy loss	(kWh)	46243
Percentage loss	(%)	5.5%

Summary of Load Flow result

Swing Bus	(MW)	2 452
Generators	(MW)	0 000
Total operating Load	(MW)	2 404
Peak losses	(MW)	0 048
Iron Loss of transformers	(MW)	0 002
Study period		45
LLF		0 58
Energy loss (Technical)	(kWh)	32713
	(%)	3.9%
Energy Loss (Non-technical)	(kWh)	13529
	(%)	1.6%

Feeder: National Insulated Cable
Bhatpara D/S

	Rating	Initial Reading (15/5/2001)					Final Reading (13/6/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading		10 45	300			146606	17 08			148790			2184	655200	1016690
						meter slow				meter slow					
HT Consumers															
1 National Insulated Cable		10 45	8			587616	16 35			657974			70358	562864	873410
3 National Pipe & Tubes		10 45	4			618314	16:48			637503			19189	76756	119104
													Sub-total	639620	992514
Energy loss in the 6 kV feeder and transformers															24176
															2.4%

Summary of energy audit result		
Input to the 6 kV feeder	(kWh)	1016690
Output energy recorded	(kWh)	992514
Total enegy loss	(kWh)	24176
Percentage loss	(%)	**2.4%**
Summary of Load Flow result		
Swing Bus	(MW)	1 696
Generators	(MW)	0 000
Total operating Load	(MW)	1 657
Peak losses	(MW)	0 039
Iron Loss of transformers	(MW)	0 000
Study period		45
LLF		0 22
Energy loss (Technical)	(kWh)	9266
	(%)	**0.9%**
Energy Loss (Non-technical)	(kWh)	14909
	(%)	**1.5%**

Feeder: United Bank of India F2
Prinsep Street D/S

	Rating	Initial Reading (22/5/2001)					Final Reading (25/6/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
	(kVA)	Time	MF	Meter Reading			Time	Meter Reading							
				Phase A	Phase B	Phase C		Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading		10 15	400			233693	10 50			235150			1457	582800	771353
Distribution Transformers															
1 Raj Bhaban O/T	315	11 45	60	427 3	492 5	354 6	12 00	624	723	548	196 7	230 5	193 4	37236	49283
2 Govt Place (E) P/T	315	11'45	60	709 2	718.6	782 8	12 05	1165	1159	1290	455 8	440 4	507 2	84204	111446
3 Larkin Ln P/T	315	11 50	60	630 5	599 1	562 8	10 35	1037	1018	922	406 1	419 0	359 1	71052	94039
4 Council House St (S) T/H No 1	315	12 00	60	524 3	375 7	408 7	11 45	878	665	678	353 3	289 6	269 2	54726	72431
5 Council House St (S) T/H No 2	315	12 00	60	335 2	173	203 4	11 50	581	292	372	245 4	119 4	168 2	31980	42326
													Sub-total	279198	369527
HT Consumers															
1 United Bank of India		10 00	0			919058	13 30			991441			72383	0	0
2 India Steamship		10 14	1			570945	13 20			663622			92677	92677	122661
3 Cooke & Kelvey		10 14	1			506818	12 35			538724			31906	31906	42229
4 Eastern Estates		10 00	1			554764	12 40			576017			21253	21253	28129
5 Saraf Agencies		10 04	1			559932	11 32			629869			69937	69937	92564
6 Council House Properties		10 06	1			1005628	11 20			1058455			52827	52827	69918
													Sub-total	268600	355500
Energy loss in the 6 kV feeder and transformers															46326
															6.0%

Summary of energy audit result

Input to the 6 kV feeder	(kWh)	771353
Output energy recorded	(kWh)	725027
Total enegy loss	(kWh)	46326
Percentage loss	(%)	**6.0%**

Summary of Load Flow result

Swing Bus	(MW)	3 565
Generators	(MW)	0 000
Total operating Load	(MW)	3 451
Peak losses	(MW)	0 114
Iron Loss of transformers	(MW)	0 003
Study period		45
LLF		0 29
Energy loss (Technical)	(kWh)	39215
	(%)	**5.1%**
Energy Loss (Non-technical)	(kWh)	7111
	(%)	**0.9%**

Feeder: Lake North T/H
Ritchie D/S

		Rating	Initial Reading (25/6/2001)					Final Reading (26/7/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
					Meter Reading				Meter Reading							
		(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Sending end reading			05 55	300			24798	12 55			27379			2581	774300	1123984
Distribution Transformers																
1	Pandıtıya (N) O/T F1	315	06 08	60	1721	1567	1522	14 50	2246	2035	2007	525	468	485	88638	128668
2	Dover Road (S) O/T F1	315	06 05	60	1514	1360	1771	14 55	1893	1704	2249	379	344	478	72060	104603
3	Pandıtıya O/T F1	200	06 15	60	223	262	256	15 00	384	343	336	161	81	80	19266	27967
4	Aswını Dutta Road P/T	315	06 30	60	2101	1641	1466		2651	1993	1793	550	352	327	73740	107042
5	Rashbehan Avenue (E) P/T F1	315	06 45	60	1615	1363	1267		2075	1728	1634	460	365	367	71520	103819
6	Panditiya Road T/H F1	300	06 25	80	385	315	344		1060	869	976	675	554	632	148880	216116
7	Panditiya Road T/H F2	315	06 26	80	311	319	382		870	890	1057	559	571	675	144400	209613
8	Rashbehari Avenue (E) O/T	300	06 45	60	1028	1098	1056		1402	1478	1447	374	380	391	68700	99726
9	Rashbehari Avenue (W) O/T	315	06 40	60	992	944	1053		1346	1409	1291	354	465	238	63420	92061
														Sub-total	750624	1089615
HT Consumers																
1	Dover Rd Co-operatıve Society			1			538808				550156			11348	11348	16473
Energy loss in the 6 kV feeder and transformers																17895
																1.6%

Summary of energy audit result		
Input to the 6 kV feeder	(kWh)	1123984
Output energy recorded	(kWh)	1106088
Total enegy loss	(kWh)	17895
Percentage loss	(%)	**1.6%**
Summary of Load Flow result		
Swing Bus	(MW)	1 631
Generators	(MW)	0 000
Total operating Load	(MW)	1 589
Peak losses	(MW)	0 042
Iron Loss of transformers	(MW)	0 006
Study period		45
LLF		0 47
Energy loss (Technical)	(kWh)	28177
	(%)	**2.5%**
Energy Loss (Non-technical)	(kWh)	-10282
	(%)	**-0.9%**

Annex 13

Load Flow Results of 6 kV Feeders

(Jadavpore D/S)

```
                    Electrical Transient Analyzer Program

                            ETAP PowerStation

                           Load Flow Analysis

                       Loading Category:   Normal
                                Normal Loading



                       Swing   Generator   Load   Total
Number of Buses:         1         0        18     19


                       XFMR2   XFMR3   Reactor   Line/Cable   Impedance   Tie PD   Total
Number of Branches:      8       0        0          10           0          0       18


Method of Solution:   Newton-Raphson Method

Maximum Number of Iteration:    5

Precision of Solution.       0.000100     MW and Mvar


System Frequency     50.00

Unit System.     Metric

Project Filename:     JADAVPORE

Output Filename:     C:\ETAPS\PowerStn\Jadavpore-6kv\Untitled.lf1
```

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limi	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0								
N4	Load	6.00	100.0	0.0								
N5	Load	6.00	100.0	0.0								
N6	Load	6.00	100.0	0.0								
N7	Load	6.00	100.0	0.0								
N8	Load	6.00	100.0	0.0								
N9	Load	6.00	100.0	0.0								
N10	Load	6.00	100.0	0.0								
N11	Load	6.00	100.0	0.0								
N44	Load	0.40	100.0	0.0			0.250	0.188				
N55	Load	0.40	100.0	0.0			0.211	0.158				
N66	Load	0.40	100.0	0.0			0.112	0.084				
N77	Load	0.40	100.0	0.0			0.245	0.184				
N88	Load	0.40	100.0	0.0			0.222	0.167				
N99	Load	0.40	100.0	0.0			0.211	0.158				
N1010	Load	0.40	100.0	0.0			0.200	0.150				
N1111	Load	0.40	100.0	0.0			0.250	0.188				
19 Buses Total					0.000	0.000	1.702	1.277	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	**ohms / 1000 m per Conductor (Cable) or per Phase (Line)**							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N10-N11			157 0	1	75	43751	08897	0001330
N1-N2			2187 0	1	75	.16621	07790	0002030
N2-N3			10 0	1	75	.12046	07898	0001940
N2-N4			314.0	1	75	12046	07898	0001890
N3-N7			10.0	1	75	48182	09421	0001110
N3-N9			139.0	1	75	49948	08819	0001440
N4-N5			261.0	1	75	40206	08888	0002280
N5-N6			129.0	1	75	23592	08464	0001550
N7-N8			350.0	1	75	48182	09421	.0001110
N9-N10			365.0	1	75	68942	09293	0001170

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T5	0.200	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T7	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T9	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T13	0.300	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T15	0.300	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T17	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	Ter Bus ID	% Min Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N4	N44	454.02	1520.98	1587.30	
T3	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T5	2W XFMR	N6	N66	715.09	2395.55	2500.00	
T7	2W XFMR	N7	N77	454.02	1520.98	1587.30	
T9	2W XFMR	N8	N88	454.02	1520.98	1587.30	
T13	2W XFMR	N9	N99	476.73	1597.03	1666.67	
T15	2W XFMR	N10	N1010	476.73	1597.03	1666.67	
T17	2W XFMR	N11	N1111	454.02	1520.98	1587.30	
N1-N2	Line/Cable	N1	N2	100.97	47.32	111.51	0.0159826
N2-N3	Line/Cable	N2	N3	0.33	0.22	0.40	0.0000698
N2-N4	Line/Cable	N4	N2	10.51	6.89	12.56	0.0021365
N3-N7	Line/Cable	N7	N3	1.34	0.26	1.36	0.0000400
N3-N9	Line/Cable	N3	N9	19.29	3.41	19.58	0.0007206
N4-N5	Line/Cable	N5	N4	29.15	6.44	29.85	0.0021423
N5-N6	Line/Cable	N5	N6	8.45	3.03	8.98	0.0007198
N7-N8	Line/Cable	N8	N7	46.84	9.16	47.73	0.0013986
N9-N10	Line/Cable	N9	N10	69.90	9.42	70.53	0.0015374
N10-N11	Line/Cable	N11	N10	19.08	3.88	19.47	0.0007517

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R (

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					Xl
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%
*N1	Swng	6 000	100 000	0 0	1 79	1 38	0 00	0 00	0 00	0.00	N2	1 79	1 38	217	79 08	
N2	Load	6 000	97.536	0 3	0 00	0.00	0 00	0 00	0.00	0.00	N1	-1.74	-1.38	218	78 39	
											N3	1.15	0 92	145	78.32	
											N4	0 59	0 46	73	78 58	
N3	Load	6 000	97 530	0 3	0 00	0 00	0.00	0.00	0.00	0 00	N2	-1.15	-0.92	145	78.32	
											N7	0.48	0.38	60	78 29	
											N9	0.68	0.54	85	78.49	
N4	Load	6 000	97 440	0 3	0 00	0 00	0 00	0 00	0 00	0.00	N2	-0.58	-0.46	73	78 44	
											N5	0.33	0.26	41	78.78	
											N44	0.26	0 20	32	78.00	
N5	Load	6 000	97 325	0 4	0 00	0 00	0 00	0 00	0 00	0 00	N4	-0.33	-0.26	41	78.51	
											N6	0.11	0 09	14	78.86	
											N55	0.21	0.17	27	78 33	
N6	Load	6 000	97 312	0 4	0 00	0.00	0 00	0.00	0 00	0.00	N5	-0.11	-0 09	14	78 63	
											N66	0 11	0.09	14	78.62	
N7	Load	6 000	97 522	0 3	0 00	0 00	0 00	0 00	0 00	0 00	N3	-0 48	-0 38	60	78 28	
											N8	0.23	0 18	28	78 50	
											N77	0 25	0 20	31	78 05	
N8	Load	6 000	97 397	0 4	0 00	0 00	0 00	0 00	0 00	0 00	N7	-0.23	-0 18	28	78 24	
											N88	0.23	0 18	28	78.24	
N9	Load	6 000	97 377	0 4	0 00	0 00	0 00	0 00	0 00	0 00	N3	-0 68	-0 54	85	78 40	
											N10	0 46	0 36	58	78 47	
											N99	0.21	0 17	27	78 24	
N10	Load	6 000	97 011	0 5	0 00	0 00	0 00	0 00	0 00	0 00	N9	-0.46	-0 37	58	78.21	
											N11	0 26	0 20	32	78 10	
											N1010	0.20	0 16	25	78 33	
N11	Load	6 000	96 952	0 5	0 00	0 00	0 00	0 00	0 00	0 00	N10	-0 26	-0 21	32	77 98	
											N1111	0 26	0 21	32	77 98	
N44	Load	0 400	93 099	-1 5	0 00	0 00	0 25	0 19	0 00	0 00	N4	-0 25	-0 19	485	80 00	
N55	Load	0 400	93 694	-1 2	0 00	0 00	0 21	0 16	0 00	0 00	N5	-0 21	-0 16	406	80 00	
N66	Load	0 400	94 304	-0 9	0 00	0 00	0 11	0 08	0 00	0 00	N6	-0 11	-0 08	214	80 00	
N77	Load	0 400	93 288	-1 5	0 00	0 00	0 24	0 18	0 00	0 00	N7	-0 24	-0 18	473	80 00	
N88	Load	0 400	93 566	-1 3	0 00	0 00	0 22	0 17	0 00	0 00	N8	-0 22	-0 17	428	80 00	
N99	Load	0 400	93 557	-1 3	0 00	0 00	0.21	0 16	0 00	0 00	N9	-0.21	-0 16	407	80 00	
N1010	Load	0 400	93 388	-1 1	0 00	0 00	0.20	0 15	0 00	0 00	N10	-0.20	-0 15	386	80.00	
N1111	Load	0 400	92 586	-1 4	0 00	0 00	0 25	0 19	0 00	0 00	N11	-0 25	-0 19	487	80.00	

* A regulate (constant kV) bus

# The flagged bus has a load mismatch of more than 0.1 MVA.

Project:
Location:
Contract:
Engineer:
Filename: JADAVPORE

PowerStation
3.0.1C

Study Case: **LF**

Page: **10**
Date: 01-18-2002
SN: TATAENERGY
Revision: Base
Config.: Normal

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# N2	6.000	97.536	5.852	# N3	6.000	97.530	5.852	# N4	6.000	97.440	5.846
# N5	6.000	97.325	5.839	# N6	6.000	97.312	5.839	# N7	6.000	97.522	5.851
# N8	6.000	97.397	5.844	# N9	6.000	97.377	5.843	# N10	6.000	97.011	5.821
# N11	6.000	96.952	5.817	* N44	0.400	93.099	0.372	* N55	0.400	93.694	0.375
* N66	0.400	94.304	0.377	* N77	0.400	93.288	0.373	* N88	0.400	93.566	0.374
* N99	0.400	93.557	0.374	* N1010	0.400	93.388	0.374	* N1111	0.400	92.586	0.370

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.315	0.328	104.00	0.313	99.37
T3	Transformer				0.315	0.274	87.06	0.264	83.81
T5	Transformer				0.200	0.144	72.23	0.140	70.00
T7	Transformer				0.315	0.320	101.55	0.306	97.14
T9	Transformer				0.315	0.289	91.87	0.278	88.25
T13	Transformer				0.315	0.275	87.23	0.264	83.81
T15	Transformer				0.300	0.260	86.57	0.250	83.33
T17	Transformer				0.315	0.328	104.05	0.313	99.37

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	m'
N1-N2	N1	N2	1.8	1.4	-1.7	-1.4	51.9	8.7	100.0	97.5	
N2-N3	N2	N3	1.2	0.9	-1.2	-0.9	0.1	0.0	97.5	97.5	
N2-N4	N2	N4	0.6	0.5	-0.6	-0.5	0.6	-1.6	97 5	97.4	
N3-N7	N3	N7	0.5	0.4	-0.5	-0.4	0.1	0.0	97.5	97.5	
N3-N9	N3	N9	0.7	0.5	-0.7	-0.5	1.5	-0.4	97.5	97.4	
N4-N5	N4	N5	0.3	0.3	-0.3	-0.3	0.5	-1.9	97.4	97.3	
T1	N4	N44	0.3	0.2	-0.3	-0.2	5.1	17.2	97.4	93.1	
N5-N6	N5	N6	0.1	0.1	-0.1	-0.1	0.0	-0.7	97.3	97.3	
T3	N5	N55	0.2	0.2	-0.2	-0.2	3.6	12.1	97.3	93.7	
T5	N6	N66	0.1	0.1	-0.1	-0.1	1.6	5.3	97.3	94.3	
N7-N8	N7	N8	0.2	0.2	-0.2	-0.2	0.4	-1.2	97.5	97.4	
T7	N7	N77	0.2	0.2	-0.2	-0.2	4.9	16.4	97.5	93.3	
T9	N8	N88	0.2	0.2	-0.2	-0.2	4.0	13.4	97.4	93.6	
N9-N10	N9	N10	0.5	0.4	-0.5	-0.4	2.6	-1.1	97 4	97.0	
T13	N9	N99	0.2	0.2	-0.2	-0.2	3.8	12.7	97.4	93 6	
N10-N11	N10	N11	0 3	0 2	-0.3	-0.2	0.2	-0.7	97.0	97.0	
T15	N10	N1010	0.2	0.2	-0.2	-0 2	3 4	11 4	97 0	93 4	
T17	N11	N1111	0.3	0.2	-0 3	-0.2	5.2	17.4	97.0	92 6	
							89.5	106.9			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	1.789	1.385	2.262	79.08 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	1.789	1.385	2.262	79.08 Lagging
Total Motor Load:	1.702	1.277	2.128	80.00 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.087	0.108		
System Mismatch:	0.004	0.003		

Number of Iterations: 3

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	7	8

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	3	0	0	4	0	0	7

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.001000 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename: AkraColony6KV

Output Filename: C:\ETAPS\PowerStn\AkraColony6KV\Untitled.lfl

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0								
N4	Load	6.00	100.0	0.0								
N5	Load	6.00	100.0	0.0								
N22	Load	0.40	100.0	0.0			0.263	0.197				
N44	Load	0.40	100.0	0.0			0.277	0.208				
N55	Load	0.40	100.0	0.0			0.194	0.145				
8 Buses Total					0.000	0.000	0.734	0.550	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			50.0	1	75	12046	07898	0001890
N2 N3			27.0	1	75	.48182	09421	0001130
N3 N4			459.0	1	75	48182	09421	0001110
N3 N5			499 0	1	75	47989	09383	0001110

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	**Rating**					**% Tap Setting**		**Imped.**
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T4	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	**Bus Numbers ("*" LTC Side)**		**Transformer Load Tap Changer Setting**					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	**Rating**			**Tap**	**Impedance**			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	**Bus Numbers ("*" LTC Side)**			**Transformer Load Tap Changer Setting**					
ID	Prim. Bus ID	Sec Bus ID	Ter Bus ID	% Min Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	**Connected Buses**		**Impedance**		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N2	N22	454.02	1520.98	1587.30	
T3	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T4	2W XFMR	N4	N44	454.02	1520.98	1587.30	
N1 N2	Line/Cable	N1	N2	1.67	1.10	2.00	0.0003402
N2 N3	Line/Cable	N2	N3	3.61	0.71	3.68	0.0001098
N3 N4	Line/Cable	N4	N3	61.43	12.01	62.60	0.0018342
N3 N5	Line/Cable	N3	N5	66.52	13.01	67.78	0.0019940

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R(

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
*N1	Swng	6.000	100.000	0.0	0.75	0.59	0.00	0.00	0.00	0.00	N2	0.75	0.59	92	78.35	
N2	Load	6.000	99.981	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N1	-0.75	-0.59	92	78.33	
											N3	0.48	0.38	58	78.53	
											N22	0.27	0.22	33	78.01	
N3	Load	6.000	99.961	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N2	-0.48	-0.38	58	78.52	
											N4	0.28	0.23	34	78.20	
											N5	0.20	0.15	23	78.99	
N4	Load	6.000	99.759	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N3	-0.28	-0.23	35	77.89	
											N44	0.28	0.23	35	77.89	
N5	Load	6.000	99.810	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N3	-0.20	-0.15	24	78.56	
											N55	0.20	0.15	24	78.56	
N22	Load	0.400	95.534	-1.9	0.00	0.00	0.26	0.20	0.00	0.00	N2	-0.26	-0.20	497	80.00	
N44	Load	0.400	95.056	-1.9	0.00	0.00	0.28	0.21	0.00	0.00	N4	-0.28	-0.21	525	80.00	
N55	Load	0.400	96.585	-1.3	0.00	0.00	0.19	0.15	0.00	0.00	N5	-0.19	-0.15	361	80.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# N22	0.400	95.534	0.382	# N44	0.400	95.056	0.380	# N55	0.400	96.585	0.386

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
* T1	Transformer				0.315	0.344	109.31	0.329	104.44
T3	Transformer				0.315	0.250	79.39	0.242	76.83
* T4	Transformer				0.315	0.363	115.28	0.346	109.84

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage	
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To
N1 N2	N1	N2	0.7	0.6	-0.7	-0.6	0.2	-0.2	100.0	100.0
N2 N3	N2	N3	0.5	0.4	-0.5	-0.4	0.1	-0.1	100.0	100.0
T1	N2	N22	0.3	0.2	-0.3	-0.2	5.4	18.0	100.0	95.5
N3 N4	N3	N4	0.3	0.2	-0.3	-0.2	0.8	-1.7	100.0	99.8
N3 N5	N3	N5	0.2	0.2	-0.2	-0.2	0.4	-1.9	100.0	99.8
T4	N4	N44	0.3	0.2	-0.3	-0.2	6.0	20.2	99.8	95.1
T3	N5	N55	0.2	0.2	-0.2	-0.1	2.9	9.5	99.8	96.6
							15.8	43.8		

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	0.749	0.594	0.956	78.35 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	.749	0.594	0.956	78.35 Lagging
Total Motor Load:	.734	0.550	0.917	80.00 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.016	0.044		
System Mismatch:	0.000	0.000		

Number of Iterations: 1

Chandalpara S/H1/Sree Hanuman J.M. (Belur D/S)

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses.	1	0	12	13

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches.	5	0	0	9	0	0	14

Method of Solution Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution 0.000100 MW and Mvar

System Frequency 50.00

Unit System. Metric

Project Filename: C-ParaShreeHanuman6kv

Output Filename C:\ETAPS\PowerStn\C-ParaShreeHanuman6kV\Untitled lfl

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Bus3	Load	0.40	100.0	0.0			0.915	0.686				
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0			0.152	0.050				
N5	Load	6.00	100.0	0.0								
N6	Load	6.00	100.0	0.0			0.348	0.137				
N7	Load	6.00	100.0	0.0			1.133	0.909				
N8	Load	6.00	100.0	0.0								
N9	Load	6.00	100.0	0.0			0.548	0.078				
N10	Load	6.00	100.0	0.0			0.463	0.335				
N11	Load	6.00	100.0	0.0								
N55	Load	0.40	100.0	0.0			0.255	0.191				
N88	Load	0.40	100.0	0.0			0.288	0.216				
13 Buses Total					0.000	0.000	4.102	2.603	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	**ohms / 1000 m per Conductor (Cable) or per Phase (Line)**							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			1690.0	1	75	14538	08092	0001730
N10 N11			217.0	1	75	24136	08610	0001430
N2 N3			559.0	1	75	12481	07538	.0002310
N2 N5			254.0	1	75	24840	08140	0001700
N2 N7			206.0	1	75	23217	08493	.0001520
N5 N6			65.0	1	75	24840	08140	0001710
N7 N8			217.0	1	75	24222	08552	0001460
N8 N10			499.0	1	75	.24091	08640	0000140
N8 N9			115.0	1	75	.74765	.09421	0001110

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.570	6.000	0.400	5.000	4.3	0.000	0.000	0.00
T5	0.400	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T7	0.400	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T9	0.400	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	Ter. Bus ID	% Min Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T3	2W XFMR	N8	N88	200.02	854.08	877.19	
T5	2W XFMR	N11	Bus3	357.54	1197.77	1250.00	
T7	2W XFMR	N11	Bus3	357.54	1197.77	1250.00	
T9	2W XFMR	N11	Bus3	357.54	1197.77	1250.00	
N1 N2	Line/Cable	N1	N2	68.25	37.99	78.11	0.0105253
N2 N3	Line/Cable	N3	N2	19.38	11.70	22.64	0.0046486
N2 N5	Line/Cable	N5	N2	17.53	5.74	18.44	0.0015545
N2 N7	Line/Cable	N7	N2	13.29	4.86	14.15	0.0011272
N5 N6	Line/Cable	N6	N5	4.49	1.47	4.72	0.0004001
N7 N8	Line/Cable	N7	N8	14.60	5.15	15.48	0.0011406
N8 N10	Line/Cable	N8	N10	33.39	11.98	35.48	0.0002515
N8 N9	Line/Cable	N8	N9	23.88	3.01	24.07	0.0004595
N10 N11	Line/Cable	N11	N10	14.55	5.19	15.45	0.0011171

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	# p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus3	Load	0 400	89 807	-1 5	0.00	0 00	0.91	0 69	0.00	0 00	N11	-0.30	-0.23	612	80.01	
											N11	-0.30	-0.23	612	80.01	
											N11	-0.30	-0.23	612	80.01	
*N1	Swng	6 000	100 000	0 0	4 37	2.80	0 00	0 00	0 00	0 00	N2	4.37	2.80	499	84.19	
N2	Load	6 000	95.954	0 2	0.00	0.00	0 00	0 00	0.00	0 00	N1	-4.18	-2.71	499	83.95	
											N3	0.15	0.05	15	95.76	
											N5	0.61	0.35	70	86.97	
											N7	3.42	2.32	414	82.82	
N3	Load	6 000	95.918	0 1	0.00	0.00	0 15	0 05	0 00	0 00	N2	-0.15	-0.05	16	95.00	
N5	Load	6.000	95 822	0 2	0 00	0.00	0 00	0 00	0 00	0 00	N2	-0.61	-0.35	70	86.87	
											N6	0.35	0.14	37	93.03	
											N55	0.26	0.21	33	77.89	
N6	Load	6 000	95.804	0.2	0 00	0 00	0.35	0.14	0.00	0.00	N5	-0.35	-0.14	37	93.00	
N7	Load	6.000	95 364	0 2	0.00	0.00	1.13	0.91	0.00	0 00	N2	-3.40	-2.31	414	82.72	
											N8	2.26	1.40	268	85.07	
N8	Load	6.000	94.941	0.3	0.00	0.00	0.00	0 00	0 00	0.00	N7	-2.25	-1.40	268	85.01	
											N10	1.41	1.09	180	79.19	
											N9	0.55	0 08	56	99.01	
											N88	0.29	0 23	37	78.59	
N9	Load	6 000	94 801	0 3	0 00	0 00	0 55	0.08	0 00	0 00	N8	-0.55	-0.08	56	99 00	
N10	Load	6 000	94 308	0 4	0.00	0 00	0 46	0 33	0.00	0 00	N8	-1.40	-1.08	180	79.05	
											N11	0.94	0.75	122	78.10	
N11	Load	6 000	94 122	0 5	0.00	0.00	0 00	0 00	0 00	0 00	N10	-0.93	-0.75	122	78.01	
											Bus3	0.31	0.25	40	77.96	
											Bus3	0.31	0.25	40	77.96	
											Bus3	0.31	0.25	40	77.96	
N55	Load	0 400	91 308	-1.8	0.00	0.00	0 26	0.19	0.00	0 00	N5	-0.26	-0 19	504	80.00	
N88	Load	0.400	92.291	-1.0	0.00	0.00	0.29	0 22	0.00	0.00	N8	-0.29	-0 22	563	80.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltage**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
* **Bus3**	0.400	89.807	0.359	# N2	6.000	95.954	5.757	# N3	6.000	95.918	5.755
# N5	6.000	95.822	5.749	# N6	6.000	95.804	5.748	# N7	6.000	95.364	5.722
* N8	6.000	94.941	5.696	* N9	6.000	94.801	5.688	* N10	6.000	94.308	5.658
* N11	6.000	94.122	5.647	* N55	0.400	91.308	0.365	* N88	0.400	92.291	0.369

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltag**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit
# indicates bus voltages violate marginal limit

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
* T1	Transformer				0.315	0.335	106.28	0.319	101.27
T3	Transformer				0.570	0.371	65.02	0.360	63.20
T5	Transformer				0.400	0.399	99.82	0.381	95.25
T7	Transformer				0.400	0.399	99.82	0.381	95.25
T9	Transformer				0.400	0.399	99.82	0.381	95.25

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		% in'
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	
T5	Bus3	N11	-0.3	-0.2	0.3	0.3	6.4	21.6	89.8	94.1	
T7	Bus3	N11	-0.3	-0.2	0.3	0.3	6.4	21.6	89.8	94.1	
T9	Bus3	N11	-0.3	-0.2	0.3	0 3	6.4	21.6	89.8	94.1	
N1 N2	N1	N2	4.4	2.8	-4.2	-2.7	183.8	92.2	100.0	96.0	
N2 N3	N2	N3	0.2	0.0	-0.2	0 0	0.1	-4.2	96.0	95.9	
N2 N5	N2	N5	0.6	0.3	-0.6	-0.3	0.9	-1.1	96.0	95.8	
N2 N7	N2	N7	3.4	2.3	-3.4	-2.3	24.6	8.0	96.0	95.4	
N5 N6	N5	N6	0.3	0.1	-0.3	-0 1	0.1	-0.3	95.8	95.8	
T1	N5	N55	0.3	0.2	-0.3	-0.2	5.5	18.6	95.8	91.3	
N7 N8	N7	N8	2.3	1.4	-2.3	-1.4	11.4	3.0	95.4	94.9	
N8 N10	N8	N10	1.4	1.1	-1.4	-1 1	11.8	4.0	94.9	94.3	
N8 N9	N8	N9	0.5	0.1	-0.5	-0.1	0.8	-0.3	94.9	94.8	
T3	N8	N88	0.3	0.2	-0.3	-0 2	3.0	13.0	94.9	92.3	
N10 N11	N10	N11	0.9	0.7	-0.9	-0 7	2.4	-0.2	94.3	94.1	
							[illegible]	[illegible]			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	4.367	2.800	5.187	84.19 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	4.367	2.800	5.187	84.19 Lagging
Total Motor Load:	4.102	2.603	4.858	84.44 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.265	0.197		
System Mismatch:	0.001	0.001		

Number of Iterations: 5

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category· Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses	1	0	17	18

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	4	0	0	13	0	0	17

Method of Solution Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution 0 001000 MW and Mvar

System Frequency 50 00

Unit System Metric

Project Filename: Belur1 32kV

Output Filename: C \ETAPS PowerStn\Mukherjee-6kv\Untitled.lfl

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max	Mi
Bus98	Load	0.40	100.0	0.0			0.211	0.158				
Bus99	Load	0.40	100.0	0.0			0.249	0.187				
Bus100	Load	0.40	100.0	0.0			0.194	0.145				
N1 Belur D/S J N Mukherje	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0								
N4	Load	6.00	100.0	0.0			0.371	0.147				
N5	Load	6.00	100.0	0.0			0.066	0.030				
N6	Load	6.00	100.0	0.0								
N7	Load	6.00	100.0	0.0								
N8 Sri Krishna	Load	6.00	100.0	0.0								
N9	Load	6.00	100.0	0.0			0.260	0.133				
N10 R Kumar	Load	6.00	100.0	0.0			0.026	0.035				
N11	Load	6.00	100.0	0.0			0.661	0.217				
N12 J N Mukherjea	Load	6.00	100.0	0.0								
N13	Load	6.00	100.0	0.0								
N14	Load	6.00	100.0	0.0			0.063	0.072				
N22	Load	0.40	100.0	0.0			0.249	0.187				
18 Buses Total					0.000	0.000	2.351	1.312	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			1266.0	1	75	23132	08489	0001520
N10 N11			102.0	1	75	24091	08640	0014160
N11 N12			76 0	1	75	74765	09421	0001100
N11 N13			72.0	1	75	24840	08140	0001700
N11 N14			98.0	1	75	24091	08640	0001420
N2 N3			48 0	1	75	74765	09421	0001100
N2-N5			964.0	1	75	.23796	08607	0001440
N3 N4			174.0	1	75	74765	09421	0001120
N5-N6			110.0	1	75	24091	08640	0001410
N6-N7			138.0	1	75	.84558	10189	0000910
N6-N9			138.0	1	75	24091	08640	0001410
N7 N8			62 0	1	75	82030	09991	0000990
N9-N10			226.0	1	75	20852	08272	0001680

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	**Rating**					**% Tap Setting**		**Imped.**
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol
T1	0.315	6.000	0.400	5.000	3.3	0.000	0 000	0.00
T2	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.315	6.000	0 400	5.000	3.3	0.000	0.000	0.00
T4	0.315	6.000	0.400	5 000	3.3	0.000	0 000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	**Bus Numbers ("*" LTC Side)**		**Transformer Load Tap Changer Setting**					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	**Rating**			**Tap**	**Impedance**			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Branch	**Bus Numbers ("*" LTC Side)**			**Transformer Load Tap Changer Setting**					
ID	Prim. Bus ID	Sec. Bus ID	Ter Bus ID	% Min Tap	% Max Tap	% Step	Reg Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	**Connected Buses**		**Impedance**		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N2	N22	454.02	1520.98	1587.30	
T2	2W XFMR	N7	Bus98	454.02	1520.98	1587.30	
T3	2W XFMR	N12 J N Mukh	Bus99	454.02	1520.98	1587.30	
T4	2W XFMR	N13	Bus100	454.02	1520.98	1587.30	
N1 N2	Line/Cable	N1 Belur D/S	N2	81.35	29.85	86.65	0.0069276
N2 N3	Line/Cable	N3	N2	9.97	1.26	10.05	0.0001901
N2-N5	Line/Cable	N2	N5	63.72	23.05	67.76	0.0049974
N3 N4	Line/Cable	N4	N3	36.14	4.55	36.42	0.0007016
N5-N6	Line/Cable	N5	N6	7.36	2.64	7.82	0.0005584
N6-N7	Line/Cable	N7	N6	32.41	3.91	32.65	0.0004521
N6-N9	Line/Cable	N6	N9	9.23	3.31	9.81	0.0007005
N7 N8	Line/Cable	N7	N8 Sri Krish	14.13	1.72	14.23	0.0002210
N9-N10	Line/Cable	N9	N10 R Kumar	13.09	5.19	14.08	0.0013668
N10 N11	Line/Cable	N10 R Kumar	N11	6.83	2.45	7.25	0.0051996
N11 N12	Line/Cable	N12 J N Mukh	N11	15.78	1.99	15.91	0.0003010
N11 N13	Line/Cable	N11	N13	4.97	1.63	5.23	0.0004406
N11 N14	Line/Cable	N11	N14	6.56	2.35	6.97	0.0005010

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								n
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			**Voltage**		**Generation**		**Motor Load**		**Static Load**		**Load Flow**					**XI**
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus98	Load	0.400	0.369	-1.2	0.00	0.00	0.21	0.16	0.00	0.00	N7	-0.21	-0.16	411	80.00	
Bus99	Load	0.400	0.364	-1.5	0.00	0.00	0.25	0.19	0.00	0.00	N12 J N Mukh	-0.25	-0.19	494	80.00	
Bus100	Load	0.400	0.369	-1.1	0.00	0.00	0.19	0.15	0.00	0.00	N13	-0.19	-0.15	379	80.00	
• N1 Belur D S	Swng	6.000	6.000	0.0	2.47	1.39	0.00	0.00	0.00	0.00	N2	2.47	1.39	272	87.23	
N2	Load	6.000	5.854	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N1 Belur D/S	-2.41	-1.37	273	86.93	
											N3	0.37	0.15	39	93.09	
											N5	1.78	1.02	202	86.80	
											N22	0.25	0.20	32	78.02	
N3	Load	6.000	5.852	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N2	-0.37	-0.15	39	93.07	
											N4	0.37	0.15	39	93.07	
N4	Load	6.000	5.843	0.3	0.00	0.00	0.37	0.15	0.00	0.00	N3	-0.37	-0.15	39	93.00	
N5	Load	6.000	5.770	0.4	0.00	0.00	0.07	0.03	0.00	0.00	N2	-1.75	-1.01	202	86.57	
											N6	1.69	0.98	195	86.39	
N6	Load	6.000	5.761	0.4	0.00	0.00	0.00	0.00	0.00	0.00	N5	-1.68	-0.98	195	86.36	
											N7	0.21	0.17	27	78.43	
											N9	1.47	0.81	168	87.49	
N7	Load	6.000	5.756	0.4	0.00	0.00	0.00	0.00	0.00	0.00	N6	-0.21	-0.17	27	78.32	
											N8 Sn Knsh	0.00	0.00	0	0.00	
											Bus98	0.21	0.17	27	78.28	
N8 Sn Knsh	Load	6.000	5.756	0.4	0.00	0.00	0.00	0.00	0.00	0.00	N7	0.00	0.00	0	0.00	
N9	Load	6.000	5.751	0.4	0.00	0.00	0.26	0.13	0.00	0.00	N6	-1.47	-0.81	168	87.46	
											N10 R Kumar	1.21	0.68	139	87.13	
N10 R Kunur	Load	6.000	5.739	0.4	0.00	0.00	0.03	0.03	0.00	0.00	N9	-1.20	-0.68	139	87.08	
											N11	1.18	0.64	135	87.71	
N11	Load	6.000	5.733	0.4	0.00	0.00	0.66	0.22	0.00	0.00	N10 R Kumar	-1.18	-0.65	135	87.55	
											N12 J N Mukh	0.25	0.20	32	77.99	
											N13	0.20	0.16	25	78.50	
											N14	0.06	0.07	9	66.26	
N12 J N Mukh	Load	6.000	5.730	0.5	0.00	0.00	0.00	0.00	0.00	0.00	N11	-0.25	-0.20	32	77.93	
											Bus99	0.25	0.20	32	77.92	
N13	Load	6.000	5.732	0.4	0.00	0.00	0.00	0.00	0.00	0.00	N11	-0.20	-0.16	25	78.42	
											Bus100	0.20	0.16	25	78.41	
N14	Load	6.000	5.732	0.4	0.00	0.00	0.06	0.07	0.00	0.00	N11	-0.06	-0.07	9	66.02	
N22	Load	0.400	0.373	-1.6	0.00	0.00	0.25	0.19	0.00	0.00	N2	-0.25	-0.19	482	80.00	

* A regulate (constant kV) bus.

The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
* Bus98	0.400	92.257	0.369	* Bus99	0.400	91.075	0.364	* Bus100	0.400	92.140	0.369
# N2	6.000	97.575	5.854	# N3	6.000	97.535	5.852	# N4	6.000	97.390	5.843
# N5	6.000	96.171	5.770	# N6	6.000	96.015	5.761	# N7	6.000	95.935	5.756
# N8 Sri Krish	6.000	95.935	5.756	# N9	6.000	95.845	5.751	# N10 R Kumar	6.000	95.644	5.739
# N11	6.000	95.543	5.733	# N12 J N Mukh	6.000	95.497	5.730	# N13	6.000	95.530	5.732
# N14	6.000	95.537	5.732	* N22	0.400	93.258	0.373				

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.315	0.326	103.55	0.312	98.97
T2	Transformer				0.315	0.274	86.91	0.263	83.58
T3	Transformer				0.315	0.327	103.78	0.312	98.97
T4	Transformer				0.315	0.251	79.81	0.242	76.98

BRANCH LOSSES Summary Report

CKT / Branch	**Connected Bus Info.**		**From-To Bus Flow**		**To-From Bus Flow**		**Losses**		**% Bus Voltage**	
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To
T2	Bus98	N7	-0.2	-0.2	0.2	0.2	3.7	12.4	92.3	95.9
T3	Bus99	N12 J N Mukh	-0.2	-0.2	0.3	0.2	5.3	17.8	91.1	95.5
T4	Bus100	N13	-0.2	-0.1	0.2	0.2	3.1	10.5	92.1	95.5
N1 N2	N1 Belur D/S	N2	2.5	1.4	-2.4	-1.4	65.4	17.3	100.0	97.6
N2 N3	N2	N3	0.4	0.1	-0.4	-0.1	0.2	-0.2	97.6	97.5
N2-N5	N2	N5	1.8	1.0	-1.8	-1.0	28.2	5.5	97.6	96.2
T1	N2	N22	0.3	0.2	-0.2	-0.2	5.1	17.0	97.6	93.3
N3 N4	N3	N4	0.4	0.1	-0.4	-0.1	0.6	-0.6	97.5	97.4
N5-N6	N5	N6	1.7	1.0	-1.7	-1.0	3.0	0.6	96.2	96.0
N6-N7	N6	N7	0.2	0.2	-0.2	-0.2	0.3	-0.4	96.0	95.9
N6-N9	N6	N9	1.5	0.8	-1.5	-0.8	2.8	0.4	96.0	95.8
N7 N8	N7	N8 Sri Krish	0.0	0.0	0.0	0.0	0.0	-0.2	95.9	95.9
N9-N10	N9	N10 R Kumar	1.2	0.7	-1.2	-0.7	2.7	-0.2	95.8	95.6
N10 N11	N10 R Kumar	N11	1.2	0.6	-1.2	-0.6	1.3	-4.3	95.6	95.5
N11 N12	N11	N12 J N Mukh	0.3	0.2	-0.3	-0.2	0.2	-0.3	95.5	95.5
N11 N13	N11	N13	0.2	0.2	-0.2	-0.2	0.0	-0.4	95.5	95.5
N11 N14	N11	N14	0.1	0.1	-0.1	-0.1	0.0	-0.5	95.5	95.5
							122.1	74.6		

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es)	2.472	1.386	2.835	87.23 Lagging
Generators	000	0.000	0.000	100.00 Lagging
Total Demand	2.472	1.386	2.835	87.23 Lagging
Total Motor Load.	2.350	1.311	2.691	87.32 Lagging
Total Static Load	0.000	0.000		
Apparent Losses.	0.122	0.075		
System Mismatch:	0.001	0.000		

Number of Iterations: 2

Sree Ambica J.M/British India R.M. (Belur D/S)

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	10	11

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	4	0	0	6	0	0	10

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.001000 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename: Ambica6KV

Output Filename: C:\ETAPS\PowerStn\Ambica6KV\Untitled.lf1

BUS Input Data

```
Bus Info. & Nominal kV        Initial Voltage      Generator          Motor Load          Static Load        Mvar Limit
  ID        Type     kV       %Mag     Ang       MW      Mvar        MW      Mvar        MW      Mvar        Max.    Mi

N1          SWNG    6.00      100.0    0.0
N2          Load    6.00      100.0    0.0
N3          Load    6.00      100.0    0.0
N4          Load    6.00      100 0    0.0
N5          Load    6.00      100.0    0.0
N6          Load    6.00      100.0    0.0                          0.356    0.072
N7          Load    6.00      100.0    0.0                          1.684    0.422
N22         Load    0.40      100.0    0.0                          0.222    0.166
N33         Load    0.40      100.0    0.0
N44         Load    0.40      100.0    0.0                          0.166    0.125
N55         Load    0.40      100.0    0.0                          0.250    0 187
                                                 ______  ______     ______   ______      ______  ______
      11 Buses Total                             0.000   0.000      2.677    0.972       0.000   0.000
```

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			10.0	1	75	12481	07538	0002220
N2 N3			14.0	1	75	12480	.07538	0002380
N3 N4			12.0	1	75	.16621	07790	0002080
N3 N5			152.0	1	75	24840	08140	0001700
N4 N6			963.0	1	75	.23735	.08564	0001470
N6 N7			410.0	1	75	.23891	08617	0001440

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T5	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T7	0.400	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	Ter Bus ID	% Min Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N2	N22	454.02	1520.98	1587.30	
T3	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T5	2W XFMR	N3	N33	454.02	1520.98	1587.30	
T7	2W XFMR	N4	N44	357.54	1197.77	1250.00	
N1 N2	Line/Cable	N1	N2	0.35	0.21	0.41	0 0000799
N2 N3	Line/Cable	N2	N3	0.49	0.29	0.57	0 0001200
N3 N4	Line/Cable	N3	N4	0.55	0.26	0.61	0.0000899
N3 N5	Line/Cable	N5	N3	10.49	3.44	11.04	0.0009302
N4 N6	Line/Cable	N4	N6	63.49	22.91	67.50	0 0050962
N6 N7	Line/Cable	N6	N7	27.21	9.81	28.92	0.0021254

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
*N1	Swng	6 000	100 000	0 0	2.73	1.01	0 00	0 00	0 00	0 00	N2	2.73	1.01	279	93.78	
N2	Load	6 000	99 988	0 0	0.00	0.00	0.00	0 00	0 00	0 00	N1	-2.73	-1 01	279	93.78	
											N3	2.50	0.83	253	94.89	
											N22	0.23	0 18	27	78.34	
N3	Load	6 000	99 974	0.0	0 00	0 00	0 00	0 00	0 00	0 00	N2	-2.50	-0 83	253	94.89	
											N4	2.24	0 63	224	96.27	
											N5	0.25	0.20	31	78.27	
											N33	0.00	0.00	0	0.00	
N4	Load	6 000	99.960	0 0	0.00	0 00	0.00	0.00	0 00	0.00	N3	-2.24	-0.63	224	96.27	
											N6	2.08	0.50	205	97.22	
											N44	0.17	0.13	20	79.04	
N5	Load	6 000	99 940	0 0	0 00	0 00	0 00	0.00	0 00	0 00	N3	-0.25	-0.20	31	78.12	
											N55	0.25	0.20	31	78.11	
N6	Load	6 000	98.525	-0.1	0.00	0.00	0.36	0.07	0.00	0 00	N4	-2.05	-0.50	205	97.20	
											N7	1.69	0.42	170	97.02	
N7	Load	6 000	98 016	-0 1	0.00	0.00	1.68	0.42	0.00	0 00	N6	-1.68	-0.42	170	97.00	
N22	Load	0 400	96 281	-1 6	0.00	0 00	0 22	0.17	0 00	0 00	N2	-0.22	-0 17	415	80.00	
N33	Load	0 400	99 974	0 0	0 00	0 00	0.00	0 00	0 00	0 00	N3	0.00	0.00	0	0.00	
N44	Load	0 400	97 811	-0 9	0 00	0 00	0 17	0 12	0 00	0 00	N4	-0.17	-0.12	306	80.00	
N55	Load	0 400	95.735	-1 8	0 00	0 00	0 25	0 19	0 00	0 00	N5	-0.25	-0.19	470	80.00	

* A regulate (constant kV) bus

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# N22	0.400	96.281	0.385	# N44	0.400	97.811	0.391	# N55	0.400	95.735	0.383

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.315	0.288	91.32	0.277	87.94
T3	Transformer				0.315	0.326	103.40	0.312	99.05
T5	Transformer				0.315	0.000	0.00	0.000	0.00
T7	Transformer				0.400	0.213	53.14	0.208	52.00

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage	
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To
N1 N2	N1	N2	2.7	1.0	-2.7	-1.0	0.3	0.1	100 0	100.0
N2 N3	N2	N3	2.5	0.8	-2.5	-0 8	0.3	0.1	100.0	100.0
T1	N2	N22	0.2	0.2	-0.2	-0.2	3.8	12.6	100 0	96.3
N3 N4	N3	N4	2.2	0.6	-2.2	-0.6	0.3	0.1	100.0	100.0
N3 N5	N3	N5	0.3	0.2	-0.3	-0.2	0.1	-0.9	100.0	99.9
T5	N3	N33	0.0	0.0	0.0	0.0			100.0	100.0
N4 N6	N4	N6	2.1	0.5	-2.0	-0.5	29.0	5.5	100.0	98.5
T7	N4	N44	0.2	0.1	-0.2	-0.1	1.6	5.4	100.0	97 8
T3	N5	N55	0.3	0.2	-0.2	-0.2	4.8	16.2	99.9	95.7
N6 N7	N6	N7	1.7	0.4	-1.7	-0 4	8.5	1.0	98.5	98.0
							48.8	40.0		

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	2.727	1.010	2.908	93.78 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	2.727	1.010	2.908	93.78 Lagging
Total Motor Load:	2.677	0.972	2.848	93.99 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.050	0.037		
System Mismatch:	0.003	0.001		

Number of Iterations: 1

Howrah Auto Telephone Exchange (NS) (Belur D/S)

Electrical Transient Analvzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	10	11

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches·	3	0	0	7	0	0	10

Method of Solution: Fast-Decoupled Method

Maximum Number of Iteration: 5

Precision of Solution 0.000100 MW and Mvar

System Frequency 50 00

Unit System· Metric

Project Filename: Belurl 32kV

Output Filename: C:\ETAPS\PowerStn\Howrah Central-6kv\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0			0.052	0.026				
N3	Load	6.00	100.0	0.0								
N4	Load	6.00	100.0	0.0			0.807	0.319				
N5	Load	6.00	100.0	0.0								
N6	Load	6.00	100.0	0.0								
N7	Load	6.00	100.0	0.0			0.118	0.076				
N8	Load	6.00	100.0	0.0								
N55	Load	0.40	100.0	0.0			0.166	0.125				
N66	Load	0.40	100.0	0.0			0.244	0.183				
N88	Load	0.40	100.0	0.0			0.222	0.166				
11 Buses Total					0.000	0.000	1.608	0.895	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			30 0	1	75	12481	07538	0002310
N2 N3			731.0	1	75	12481	07538	0002310
N3 N4			383.0	1	75	.16621	07790	0002030
N4 N5			129 0	1	75	22441	08339	0001610
N5 N6			498 0	1	75	20252	08086	0001800
N6 N7			138.0	1	75	24840	08140	0001690
N7 N8			149.0	1	75	.74765	09421	0001120

Line / Cable resistance are listed at the specified temperature

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T29	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T31	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T33	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter Bus ID	% Min. Tap	% Max .Tap	% Step	Reg Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T29	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T31	2W XFMR	N6	N66	454.02	1520.98	1587.30	
T33	2W XFMR	N8	N88	454.02	1520.98	1587.30	
N1 N2	Cable	N1	N2	1.04	0.63	1.22	0.0002495
N2 N3	Cable	N3	N2	25.34	15.31	29.61	0.0060790
N3 N4	Cable	N3	N4	17.68	8.29	19.53	0.0027990
N4 N5	Cable	N4	N5	8.04	2.99	8.58	0.0007477
N5 N6	Cable	N5	N6	28.02	11.19	30.17	0.0032270
N6 N7	Cable	N6	N7	9.52	3.12	10.02	0.0008396
N7 N8	Cable	N7	N8	30.94	3.90	31.19	0.0006008

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R(

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
*N1	Swng	6.000	100.000	0.0	1.64	0.93	0.00	0.00	0.00	0.00	N2	1.64	0.93	180	87.03	
N2	Load	6.000	99.977	0.0	0.00	0.00	0.05	0.03	0.00	0.00	N1	-1.64	-0.93	180	87.02	
											N3	1.58	0.90	175	86.96	
N3	Load	6.000	99.437	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N2	-1.58	-0.90	175	86.83	
											N4	1.58	0.90	175	86.83	
N4	Load	6.000	99.082	0.0	0.00	0.00	0.81	0.32	0.00	0.00	N3	-1.57	-0.90	175	86.75	
											N5	0.76	0.58	93	79.52	
N5	Load	6.000	99.003	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N4	-0.76	-0.58	93	79.47	
											N6	0.59	0.45	72	79.68	
											N55	0.17	0.13	20	78.75	
N6	Load	6.000	98.784	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N5	-0.59	-0.45	72	79.44	
											N7	0.34	0.25	41	80.41	
											N66	0.25	0.20	30	78.11	
N7	Load	6.000	98.742	0.1	0.00	0.00	0.12	0.08	0.00	0.00	N6	-0.34	-0.25	41	80.31	
											N8	0.23	0.18	28	78.34	
N8	Load	6.000	98.665	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N7	-0.22	-0.18	28	78.21	
											N88	0.23	0.18	28	78.29	
N55	Load	0.400	96.226	-1.2	0.00	0.00	0.17	0.12	0.00	0.00	N5	-0.17	-0.12	311	80.00	
N66	Load	0.400	94.627	-1.7	0.00	0.00	0.24	0.18	0.00	0.00	N6	-0.24	-0.18	464	80.00	
N88	Load	0.400	94.901	-1.5	0.00	0.00	0.22	0.17	0.00	0.00	N8	-0.22	-0.17	421	80.00	

* A regulate (constant kV) bus

# The flagged bus has a load mismatch of more than 0.1 MVA

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# N55	0.400	96.226	0.385	* N66	0.400	94.627	0.379	* N88	0.400	94.901	0.38

Note· * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note. * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T29	Transformer				0.315	0.214	67.88	0.208	65.98
T31	Transformer				0.315	0.318	101.02	0.305	96.77
T33	Transformer				0.315	0.288	91.46	0.277	87.97

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	in
N1 N2	N1	N2	1.6	0.9	-1.6	-0.9	0.4	0.0	100.0	100.0	
N2 N3	N2	N3	1.6	0.9	-1.6	-0.9	8.4	-1.0	100.0	99 4	
N3 N4	N3	N4	1.6	0.9	-1.6	-0.9	5.9	0.0	99.4	99 1	
N4 N5	N4	N5	0.8	0.6	-0.8	-0.6	0.8	-0.5	99.1	99.0	
N5 N6	N5	N6	0.6	0.5	-0.6	-0.5	1.6	-2.5	99 0	98.8	
T29	N5	N55	0.2	0.1	-0.2	-0.1	2.1	7.1	99.0	96.2	
N6 N7	N6	N7	0.3	0.3	-0.3	-0.3	0.2	-0.8	98.8	98.7	
T31	N6	N66	0.2	0.2	-0.2	-0.2	4.7	15.8	98.8	94.6	
N7 N8	N7	N8	0.2	0.2	-0.2	-0.2	0.3	-0.6	98.7	98.7	
T33	N8	N88	0.2	0.2	-0.2	-0.2	3.9	13.0	98 7	94.9	
							28.2	30.6			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	1.636	0.926	1.880	87.02 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	1.636	0.926	1.880	87.02 Lagging
Total Motor Load:	1.608	0.896	1.841	87.37 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.028	0.031		
System Mismatch:	0.002	0.000		

Number of Iterations: 4

Sarvamangala Prop/Canning St. (W) P/T (Jackson Lane D/S)

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	15	16

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	7	0	0	10	0	0	17

Method of Solution Fast-Decoupled Method

Maximum Number of Iteration 5

Precision of Solution 0 000100 MW and Mvar

System Frequency 50 00

Unit System Metric

Project Filename. JACKSON

Output Filename: C \ETAPS'PowerStn\Jackson-6kv\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Bus7	Load	0.40	97.3	-0.9			0.333	0.250				
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0			0.167	0.034				
N3	Load	6.00	100.0	0.0			0 143	0.126				
N4	Load	6.00	100.0	0.0								
N5	Load	6.00	100 0	0.0								
N6	Load	6.00	100.0	0.0			0.115	0.092				
N7	Load	6.00	100.0	0.0								
N8	Load	6.00	100.0	0.0								
N9	Load	6.00	100.0	0 0			0.016	0.020				
N10	Load	6.00	100.0	0.0								
N11	Load	6.00	100.0	0.0			0.214	0.062				
N55	Load	0.40	100.0	0.0			0.333	0.250				
N88	Load	0.40	100.0	0.0			0.222	0.166				
N100	Load	0.40	100 0	0.0			0.388	0.291				
N-77	Load	0.40	95 4	-2.2			0.277	0.208				
16 Buses Total					0 000	0 000	2.206	1 498	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Librarv	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			318 0	1	75	22588	08469	0001540
N1 N7			261.0	1	75	24177	08582	0001450
N10 N11			153.0	1	75	24708	08228	0001650
N2 N3			94 0	1	75	74765	09421	0001120
N3 N4			184.0	1	75	74765	09421	0001120
N3 N5			156.0	1	75	24840	08140	0001690
N4 N6			57 0	1	75	74765	09421	0001120
N7 N8			214.0	1	75	24203	08565	0001450
N8 N9			91 0	1	75	24091	08640	0001400
N9 N10			215.0	1	75	.24363	08458	0001510

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T2	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T4	0.450	6.000	0.400	5.000	3.2	0.000	0.000	0.00
T6	0.400	6.000	0.400	5.000	3.2	0.000	0.000	0.00
T9	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T11	0.400	6.000	0.400	5.000	3.2	0.000	0.000	0.00
T13	0.400	6.000	0.400	5.000	3.2	0.000	0.000	0.00
T15	0.400	6.000	0.400	5.000	3.2	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Branch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim Bus ID	Sec. Bus ID	Ter Bus ID	% Min Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T2	2W XFMR	N8	N88	454.02	1520.98	1587.30	
T4	2W XFMR	N10	N100	333.31	1059.94	1111.11	
T6	2W XFMR	N5	N55	374.98	1192.43	1250.00	
T9	2W XFMR	N7	N-77	454.02	1520.98	1587.30	
T11	2W XFMR	N5	N55	374.98	1192.43	1250.00	
T13	2W XFMR	N4	Bus7	374.98	1192.43	1250.00	
T15	2W XFMR	N4	Bus7	374.98	1192.43	1250.00	
N1 N2	Cable	N1	N2	19.95	7.48	21.31	0.0017630
N1 N7	Cable	N1	N7	17.53	6.22	18.60	0.0013624
N2 N3	Cable	N2	N3	19.52	2.46	19.68	0.0003790
N3 N4	Cable	N3	N4	38.21	4.82	38.52	0.0007419
N3 N5	Cable	N3	N5	10.76	3.53	11.33	0.0009491
N4 N6	Cable	N4	N6	11.84	1.49	11.93	0.0002298
N7 N8	Cable	N8	N7	14.39	5.09	15.26	0.0011171
N8 N9	Cable	N9	N8	6.09	2.18	6.47	0.0004586
N9 N10	Cable	N9	N10	14.55	5.05	15.40	0.0011687
N10 N11	Cable	N10	N11	10.50	3.50	11.07	0.0009088

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R (

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus7	Load	0.400	97.145	-0.7	0.00	0.00	0.33	0.25	0.00	0.00	N4	-0.17	-0.12	309	80.00	
											N4	-0.17	-0.12	309	80.00	
* N1	Swng	6.000	100.000	0.0	2.25	1.58	0.00	0.00	0.00	0.00	N2	1.10	0.77	129	82.00	
											N7	1.14	0.80	134	81.73	
N2	Load	6.000	99.722	0.0	0.00	0.00	0.17	0.03	0.00	0.00	N1	-1.10	-0.77	129	81.90	
											N3	0.93	0.74	114	78.48	
N3	Load	6.000	99.521	0.1	0.00	0.00	0.14	0.13	0.00	0.00	N2	-0.93	-0.74	114	78.39	
											N4	0.45	0.35	55	78.89	
											N5	0.34	0.26	41	79.15	
N4	Load	6.000	99.331	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N3	-0.45	-0.35	55	78.76	
											N6	0.11	0.09	14	78.07	
											Bus7	0.17	0.13	20	79.04	
											Bus7	0.17	0.13	20	79.04	
N5	Load	6.000	99.476	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N3	-0.34	-0.26	41	79.03	
											N55	0.17	0.13	20	79.05	
											N55	0.17	0.13	20	79.05	
N6	Load	6.000	99.316	0.2	0.00	0.00	0.11	0.09	0.00	0.00	N4	-0.11	-0.09	14	77.98	
N7	Load	6.000	99.750	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N1	-1.14	-0.80	134	81.64	
											N8	0.86	0.58	99	82.89	
											N-77	0.28	0.23	35	77.88	
N8	Load	6.000	99.597	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N7	-0.85	-0.58	99	82.82	
											N9	0.63	0.40	71	84.43	
											N88	0.23	0.18	27	78.33	
N9	Load	6.000	99.550	0.1	0.00	0.00	0.02	0.02	0.00	0.00	N8	-0.63	-0.40	71	84.39	
											N10	0.61	0.38	69	84.97	
N10	Load	6.000	99.441	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N9	-0.61	-0.38	69	84.89	
											N11	0.21	0.06	21	96.11	
											N100	0.40	0.32	49	77.95	
N11	Load	6.000	99.416	0.1	0.00	0.00	0.21	0.06	0.00	0.00	N10	-0.21	-0.06	21	96.00	
N55	Load	0.400	97.293	-0.8	0.00	0.00	0.33	0.25	0.00	0.00	N5	-0.17	-0.12	308	80.00	
											N5	-0.17	-0.12	308	80.00	
N88	Load	0.400	95.874	-1.5	0.00	0.00	0.22	0.17	0.00	0.00	N8	-0.22	-0.17	417	80.00	
N100	Load	0.400	94.767	-1.8	0.00	0.00	0.39	0.29	0.00	0.00	N10	-0.39	-0.29	738	80.00	
N-77	Load	0.400	95.046	-1.9	0.00	0.00	0.28	0.21	0.00	0.00	N7	-0.28	-0.21	525	80.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# Bus7	0.400	97.145	0.389	# N55	0.400	97.293	0.389	# N88	0.400	95.874	0.383
* N100	0.400	94.767	0.379	# N-77	0.400	95.046	0.380				

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T2	Transformer				0.315	0.288	91.35	0.277	87.94
* T4	Transformer				0.450	0.509	113.09	0.485	107.78
T6	Transformer				0 400	0.213	53.17	0.208	52.00
* T9	Transformer				0.315	0.363	115.28	0.346	109.84
T11	Transformer				0.400	0.213	53.17	0.208	52.00
T13	Transformer				0.400	0.213	53.17	0.208	52.00
T15	Transformer				0.400	0.213	53.17	0.208	52.00

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	m'
T13	Bus7	N4	-0.2	-0.1	0.2	0.1	1.7	5.5	97.1	99.3	
T15	Bus7	N4	-0.2	-0.1	0.2	0.1	1.7	5.5	97 1	99.3	
N1 N2	N1	N2	1 1	0.8	-1.1	-0.8	3.6	-0 4	100.0	99.7	
N1 N7	N1	N7	1.1	0.8	-1.1	-0.8	3.4	-0.1	100.0	99.7	
N2 N3	N2	N3	0.9	0.7	-0.9	-0.7	2.8	0.0	99.7	99.5	
N3 N4	N3	N4	0.5	0.4	-0.5	-0.4	1.3	-0.6	99.5	99.3	
N3 N5	N3	N5	0.3	0 3	-0.3	-0.3	0.2	-0.9	99.5	99.5	
N4 N6	N4	N6	0.1	0.1	-0.1	-0 1	0.0	-0.2	99.3	99.3	
T6	N5	N55	0.2	0.1	-0.2	-0.1	1.7	5.4	99.5	97.3	
T11	N5	N55	0.2	0.1	-0.2	-0.1	1.7	5.4	99.5	97.3	
N7 N8	N7	N8	0.9	0.6	-0.9	-0.6	1.5	-0.6	99 7	99.6	
T9	N7	N-77	0.3	0.2	-0.3	-0.2	6.0	20.2	99.7	95.0	
N8 N9	N8	N9	0 6	0.4	-0 6	-0 4	0.3	-0.3	99 6	99.5	
T2	N8	N88	0.2	0.2	-0.2	-0.2	3.8	12.7	99 6	95.9	
N9 N10	N9	N10	0.6	0.4	-0.6	-0 4	0.8	-0.9	99.5	99.4	
N10 N11	N10	N11	0 2	0 1	-0 2	-0.1	0.1	-0 9	99 4	99 4	
T4	N10	N100	0.4	0.3	-0 4	-0 3	8.7	27.8	99 4	94 8	
							39 4	77 5			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	2.245	1.575	2.743	81.86 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	2.245	1.575	2.743	81 86 Lagging
Total Motor Load:	2.207	1.498	2.667	82.74 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.039	0.078		
System Mismatch:	0.002	0.000		

Number of Iterations: 4

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses.	1	0	14	15

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	5	0	0	9	0	0	14

Method of Solution Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution 0.000100 MW and Mvar

System Frequency 50.00

Unit System. Metric

Project Filename: CESC1

Output Filename. C:\ETAPS\PowerStn\Park St 6 KV\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Bus3	Load	0.40	100.0	0.0			0.161	0.121				
Bus5	Load	0.40	100.0	0.0			0.222	0.166				
Bus7	Load	0.40	94.8	-1.9			0.222	0.166				
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0								
N4	Load	6.00	100.0	0.0								
N5	Load	6.00	100.0	0.0			0.149	0.021				
N6	Load	6.00	100.0	0.0								
N7	Load	6.00	100.0	0.0			0.332	0.214				
N8	Load	6.00	100.0	0.0			0.126	0.071				
N9	Load	6.00	100.0	0.0			0.502	0.298				
N10	Load	6.00	100.0	0.0			0.133	0.106				
N22	Load	0.40	100.0	0.0			0.250	0.187				
N33	Load	0.40	100.0	0.0			0.166	0.125				
15 Buses Total					0.000	0.000	2.262	1.477	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	**ohms / 1000 m per Conductor (Cable) or per Phase (Line)**							
ID	**Library**	**Size**	**L(m)**	**#ph**	**T (C)**	**R**	**X**	**Y**
N1 N2			700.0	1	75	12481	07538	0002310
N2 N3			30.0	1	75	12481	07538	.0002310
N3 N4			205.0	1	75	12481	07538	0002300
N4 N5			131.0	1	75	12481	07538	0002310
N5 N6			151.0	1	75	12481	07538	0002300
N6 N7			475.0	1	75	12481	07538	0002300
N7 N8			157.0	1	75	12481	07538	0002300
N8 N10			1060.0	1	75	12481	07538	0002300
N8 N9			267.0	1	75	12481	07538	0002300

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.600	6.000	0.400	5.000	4.3	0.000	0.000	0.00
T3	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T5	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T7	0.600	6.000	0.400	5.000	4.3	0.000	0.000	0.00
T9	0.300	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec Bus ID	Ter. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N2	N22	190.02	811.38	833.33	
T3	2W XFMR	N3	N33	454.02	1520.98	1587.30	
T5	2W XFMR	N4	Bus3	454.02	1520.98	1587.30	
T7	2W XFMR	N6	Bus5	190.02	811.38	833.33	
T9	2W XFMR	N7	Bus7	476.73	1597.03	1666.67	
N1 N2	Line/Cable	N1	N2	24.27	14.66	28.35	0.0058212
N2 N3	Line/Cable	N2	N3	1.04	0.63	1.22	0.0002495
N3 N4	Line/Cable	N3	N4	7.11	4.29	8.30	0.0016974
N4 N5	Line/Cable	N4	N5	4.54	2.74	5.31	0.0010894
N5 N6	Line/Cable	N5	N6	5.24	3.16	6.12	0.0012503
N6 N7	Line/Cable	N7	N6	16.47	9.95	19.24	0.0039330
N7 N8	Line/Cable	N8	N7	5.44	3.29	6.36	0.0013000
N8 N10	Line/Cable	N10	N8	36.75	22.20	42.93	0.0087768
N8 N9	Line/Cable	N9	N8	9.26	5.59	10.81	0.0022108

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T(C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus3	Load	0.400	0.385	-1.1	0.00	0.00	0.16	0.12	0.00	0.00	N4	-0.16	-0.12	301	80.00	
Bus5	Load	0.400	0.388	-0.9	0.00	0.00	0.22	0.17	0.00	0.00	N6	-0.22	-0.17	412	80.00	
Bus7	Load	0.400	0.378	-1.7	0.00	0.00	0.22	0.17	0.00	0.00	N7	-0.22	-0.17	423	80.00	
* N1	Swng	6.000	6.000	0.0	2.31	1.51	0.00	0.00	0.00	0.00	N2	2.31	1.51	265	83.60	
N2	Load	6.000	5.953	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N1	-2.29	-1.51	265	83.49	
											N3	2.04	1.31	234	84.06	
											N22	0.25	0.20	30	78.95	
N3	Load	6.000	5.951	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N2	-2.04	-1.31	234	84.05	
											N4	1.87	1.18	214	84.54	
											N33	0.17	0.13	20	78.75	
N4	Load	6.000	5.940	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N3	-1.86	-1.18	214	84.50	
											N5	1.70	1.05	194	85.05	
											Bus3	0.16	0.13	20	78.79	
N5	Load	6.000	5.934	0.0	0.00	0.00	0.15	0.02	0.00	0.00	N4	-1.70	-1.05	194	85.02	
											N6	1.55	1.03	180	83.26	
N6	Load	6.000	5.927	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N5	-1.55	-1.03	181	83.23	
											N7	1.32	0.86	153	83.93	
											Bus5	0.22	0.17	27	79.06	
N7	Load	6.000	5.908	0.0	0.00	0.00	0.33	0.21	0.00	0.00	N6	-1.32	-0.86	153	83.81	
											N8	0.76	0.46	87	85.38	
											Bus7	0.23	0.18	28	78.19	
N8	Load	6.000	5.905	0.0	0.00	0.00	0.13	0.07	0.00	0.00	N7	-0.76	-0.47	87	85.32	
											N10	0.13	0.10	16	80.46	
											N9	0.50	0.30	57	86.16	
N9	Load	6.000	5.901	0.0	0.00	0.00	0.50	0.30	0.00	0.00	N8	-0.50	-0.30	57	86.00	
N10	Load	6.000	5.901	0.0	0.00	0.00	0.13	0.11	0.00	0.00	N8	-0.13	-0.11	16	78.00	
N22	Load	0.400	0.389	-1.0	0.00	0.00	0.25	0.19	0.00	0.00	N2	-0.25	-0.19	463	80.00	
N33	Load	0.400	0.386	-1.2	0.00	0.00	0.17	0.12	0.00	0.00	N3	-0.17	-0.12	311	80.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 90 % - Marginal Limit = 85 %.

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 110 % - Marginal Limit = 120 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.600	0 319	53.11	0.312	52.00
T3	Transformer				0.315	0.214	67 93	0.208	66.03
T5	Transformer				0 315	0.207	65.59	0.201	63.81
T7	Transformer				0.600	0.282	47 04	0.277	46.17
T9	Transformer				0.600	0.289	48.11	0.277	46.17

BRANCH LOSSES Summary Report

CKT / Branch	**Connected Bus Info.**		**From-To Bus Flow**		**To-From Bus Flow**		**Losses**		**% Bus Voltage**		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	in
T5	Bus3	N4	-0.2	-0.1	0.2	0.1	2.0	6.6	96.3	99.0	
T7	Bus5	N6	-0.2	-0.2	0.2	0.2	1.6	6.6	96.9	98.8	
T9	Bus7	N7	-0.2	-0.2	0.2	0.2	4 1	13.7	94 5	98.5	
N1 N2	N1	N2	2.3	1.5	-2.3	-1.5	18.5	5.4	100.0	99.2	
N2 N3	N2	N3	2.0	1.3	-2.0	-1.3	0.6	0.1	99.2	99.2	
T1	N2	N22	0 3	0.2	-0.2	-0.2	2.0	8.4	99.2	97.2	
N3 N4	N3	N4	1.9	1.2	-1.9	-1.2	3.5	0.5	99.2	99.0	
T3	N3	N33	0.2	0.1	-0.2	-0.1	2.1	7.1	99.2	96.4	
N4 N5	N4	N5	1.7	1.1	-1.7	-1.1	1.9	0.1	99.0	98.9	
N5 N6	N5	N6	1.5	1.0	-1.5	-1.0	1.9	-0.1	98 9	98.8	
N6 N7	N6	N7	1.3	0.9	-1.3	-0.9	4.2	-1.3	98.8	98.5	
N7 N8	N7	N8	0.8	0.5	-0.8	-0.5	0.4	-1.0	98.5	98.4	
N8 N10	N8	N10	0.1	0.1	-0.1	-0.1	0.1	-8.4	98 4	98.3	
N8 N9	N8	N9	0.5	0 3	-0.5	-0.3	0.3	-1.9	98 4	98.4	
							43.1	35.7			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es)	2.305	1.513	2.757	83.60 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand	2.305	1.513	2.757	83.60 Lagging
Total Motor Load:	2.262	1.477	2.702	83.74 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.043	0.036		
System Mismatch:	0.001	0.001		

Number of Iterations: 2

3 Way L/C No. 1 At D/S (Hide Rd. D/S)

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	26	27

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	6	0	0	20	0	0	26

Method of Solution Newton-Raphson Method

Maximum Number of Iteration 5

Precision of Solution 0.000100 MW and Mvar

System Frequency 50.00

Unit System Metric

Project Filename HideRd6KV

Output Filename: C:\ETAPS\PowerStn\HideRd6KV\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Bus2	Load	0.40	100.0	0.0			0.044	0.033				
Bus5	Load	0.40	100.0	0.0			0.138	0.104				
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0			0.423	0.193				
N4	Load	6.00	100.0	0.0			0.024	0.024				
N5	Load	6.00	100.0	0.0								
N6	Load	6.00	100.0	0.0			0.085	0.028				
N7	Load	6.00	100.0	0.0			0.007	0.005				
N8	Load	6.00	100.0	0.0			0.450	0.255				
N9	Load	6.00	100.0	0.0			0.069	0.070				
N10	Load	6.00	100.0	0.0								
N11	Load	6.00	100.0	0.0								
N12	Load	6.00	100.0	0.0			0.013	0.013				
N13	Load	6.00	100.0	0.0								
N14	Load	6.00	100.0	0.0								
N15	Load	6.00	100.0	0.0			0.342	0.100				
N16	Load	6.00	100.0	0.0								
N17	Load	6.00	100.0	0.0			0.103	0.047				
N18	Load	6.00	100.0	0.0								
N19	Load	6.00	100.0	0.0			0.154	0.031				
N20	Load	6.00	100.0	0.0			0.067	0.054				
N21	Load	6.00	100.0	0.0								
N55	Load	0.40	100.0	0.0			0.147	0.091				
N66	Load	0.40	100.0	0.0			0.100	0.075				
N188	Load	0.40	100.0	0.0			0.138	0.104				
N666	Load	0.40	100.0	0.0			0.100	0.075				
27 Buses Total					0.000	0.000	2.405	1.301	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	**Library**	**Size**	**L(m)**	**#/ph**	**T (C)**	**R**	**X**	**Y**
N1 N2			20.0	1	75	12481	07538	0002360
N10 N11			370.0	1	75	51893	09069	.0001250
N10 N12			168.0	1	75	74765	09421	.0001110
N12 N13			445.0	1	75	74765	09421	0001110
N13 N14			30.0	1	75	74765	09421	0001110
N15 N16			107.0	1	75	19065	08068	.0001820
N16 N17			207.0	1	75	85863	10291	.0000890
N16 N20			482.0	1	75	23774	08428	.0001540
N17 N18			340.0	1	75	85099	10231	0000900
N18 N19			124.0	1	75	.86995	.10380	.0000850
N2 N3			1731.0	1	75	16389	07801	.0002020
N2 N6			1572.0	1	75	14479	08083	0001740
N20 N21			343.0	1	75	.23911	.08522	0001490
N3 N4			30.0	1	75	74765	09421	0001110
N3 N5			2068.0	1	75	19677	08077	.0001800
N6 N15			115.0	1	75	.22577	.08496	0001520
N6 N7			19.0	1	75	74765	09421	0001170
N6 N8			66.0	1	75	16621	07790	0002020
N8 N9			92.0	1	75	15853	07901	0001930
N9 N10			270.0	1	75	24091	08640	0001420

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.200	6.000	0.400	5.000	2.7	0.000	0.000	0.00
T4	0.200	6.000	0.400	5.000	2.7	0.000	0.000	0.00
T6	0.200	6.000	0.400	5.000	2.7	0.000	0.000	0.00
T8	0.200	6.000	0.400	5.000	2.7	0.000	0.000	0.00
T10	0.200	6.000	0.400	5.000	2.7	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter. Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T3	2W XFMR	N6	N66	873.98	2342.26	2500.00	
T4	2W XFMR	N6	N666	873.98	2342.26	2500.00	
T6	2W XFMR	N11	Bus2	873.98	2342.26	2500.00	
T8	2W XFMR	N13	Bus5	873.98	2342.26	2500.00	
T10	2W XFMR	N18	N188	873.98	2342.26	2500.00	
N1 N2	Line/Cable	N1	N2	0.69	0.42	0.81	0.0001699
N2 N3	Line/Cable	N3	N2	78.80	37.51	87.28	0.0125878
N2 N6	Line/Cable	N2	N6	63.22	35.30	72.41	0.0098470
N3 N4	Line/Cable	N4	N3	6.23	0.79	6.28	0.0001199
N3 N5	Line/Cable	N5	N3	113.03	46.40	122.19	0.0134006
N6 N15	Line/Cable	N6	N15	7.21	2.71	7.71	0.0006293
N6 N7	Line/Cable	N6	N7	3.95	0.50	3.98	0.0000800
N6 N8	Line/Cable	N8	N6	3.05	1.43	3.37	0.0004800
N8 N9	Line/Cable	N8	N9	4.05	2.02	4.53	0.0006392
N9 N10	Line/Cable	N10	N9	18.07	6.48	19.20	0.0013802
N10 N11	Line/Cable	N11	N10	53.33	9.32	54.14	0.0016650
N10 N12	Line/Cable	N12	N10	34.89	4.40	35.17	0.0006713
N12 N13	Line/Cable	N13	N12	92.42	11.65	93.15	0.0017782
N13 N14	Line/Cable	N14	N13	6.23	0.79	6.28	0.0001199
N15 N16	Line/Cable	N15	N16	5.67	2.40	6.15	0.0007011
N16 N17	Line/Cable	N17	N16	49.37	5.92	49.72	0.0006632
N16 N20	Line/Cable	N16	N20	31.83	11.28	33.77	0.0026722
N17 N18	Line/Cable	N18	N17	80.37	9.66	80.95	0.0011016
N18 N19	Line/Cable	N19	N18	29.96	3.58	30.18	0.0003794
N20 N21	Line/Cable	N21	N20	22.78	8.12	24.19	0.0018399

EQUIPMENT CABLE Input Data

Cable	**Connection**			**ohms / 1000 m per Conductor**								**(** **H**
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R(

LOAD FLOW REPORT

Bus Info. & Nominal kV			**Voltage**		**Generation**		**Motor Load**		**Static Load**		**Load Flow**					**XI**
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus2	Load	0.400	97.125	-0.4	0.00	0.00	0.04	0.03	0.00	0.00	N11	-0.04	-0.03	82	80.00	
Bus5	Load	0.400	94.256	-1.4	0.00	0.00	0.14	0.10	0.00	0.00	N13	-0.14	-0.10	264	80.00	
* N1	Swng	6.000	100.000	0.0	2.45	1.30	0.00	0.00	0.00	0.00	N2	2.45	1.30	267	88.36	
N2	Load	6.000	99.978	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N1	-2.45	-1.30	267	88.36	
											N3	0.60	0.29	64	90.10	
											N6	1.85	1.01	202	87.79	
N3	Load	6.000	99.394	0.0	0.00	0.00	0.42	0.19	0.00	0.00	N2	-0.60	-0.30	64	89.36	
											N4	0.02	0.02	3	71.12	
											N5	0.15	0.08	16	87.36	
N4	Load	6.000	99.392	0.0	0.00	0.00	0.02	0.02	0.00	0.00	N3	-0.02	-0.02	3	70.94	
N5	Load	6.000	99.183	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N3	-0.15	-0.10	17	83.99	
											N55	0.15	0.10	17	83.99	
N6	Load	6.000	98.448	0.0	0.00	0.00	0.08	0.03	0.00	0.00	N2	-1.82	-1.00	203	87.60	
											N15	0.81	0.34	85	92.35	
											N7	0.01	0.00	0	82.65	
											N8	0.72	0.48	84	83.32	
											N66	0.10	0.08	12	78.91	
											N666	0.10	0.08	12	78.91	
N7	Load	6.000	98.448	0.0	0.00	0.00	0.01	0.00	0.00	0.00	N6	-0.01	0.00	0	82.22	
N8	Load	6.000	98.419	0.0	0.00	0.00	0.45	0.25	0.00	0.00	N6	-0.72	-0.48	84	83.29	
											N9	0.27	0.22	34	77.00	
N9	Load	6.000	98.404	0.0	0.00	0.00	0.07	0.07	0.00	0.00	N8	-0.27	-0.22	34	76.91	
											N10	0.20	0.15	24	79.40	
N10	Load	6.000	98.357	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N9	-0.20	-0.15	24	79.13	
											N11	0.04	0.03	5	80.92	
											N12	0.16	0.12	19	78.63	
N11	Load	6.000	98.329	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N10	-0.04	-0.03	5	79.52	
											Bus2	0.04	0.03	5	79.53	
N12	Load	6.000	98.296	0.0	0.00	0.00	0.01	0.01	0.00	0.00	N10	-0.15	-0.12	19	78.45	
											N13	0.14	0.11	17	78.98	
N13	Load	6.000	98.150	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N12	-0.14	-0.11	17	78.46	
											N14	0.00	0.00	0	0.00	
											Bus5	0.14	0.11	17	78.46	
N14	Load	6.000	98.150	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N13	0.00	0.00	0	0.00	
N15	Load	6.000	98.380	0.0	0.00	0.00	0.34	0.10	0.00	0.00	N6	-0.81	-0.34	85	92.32	
											N16	0.47	0.24	51	89.19	

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
N16	Load	6.000	98.347	0.0	0.00	0.00	0.00	0.00	0.00	0.00	N15	-0.47	-0 24	51	89.13	
											N17	0.40	0.19	43	90.50	
											N20	0.07	0.05	8	80.48	
N17	Load	6 000	98.135	0 0	0 00	0.00	0.10	0.05	0.00	0.00	N16	-0.40	-0.19	43	90.42	
											N18	0.30	0.14	32	90.21	
N18	Load	6.000	97.879	0.1	0.00	0.00	0.00	0.00	0.00	0 00	N17	-0.30	-0.14	32	90.05	
											N19	0.15	0.03	15	98.05	
											N188	0.14	0.11	17	78.45	
N19	Load	6.000	97.830	0 1	0.00	0 00	0.15	0.03	0.00	0 00	N18	-0.15	-0 03	15	98.00	
N20	Load	6 000	98.320	0.0	0.00	0.00	0.07	0.05	0.00	0.00	N16	-0.07	-0.05	8	78.99	
											N21	0.00	0.00	0	0.00	
N21	Load	6.000	98.320	0.0	0.00	0.00	0.00	0.00	0.00	0 00	N20	0.00	0.00	0	0.00	
N55	Load	0.400	97.046	-1.1	0.00	0.00	0.15	0.09	0.00	0 00	N5	-0.15	-0.09	257	85.00	
N66	Load	0.400	95.683	-1.0	0.00	0.00	0.10	0.08	0 00	0.00	N6	-0.10	-0 08	188	80.00	
N188	Load	0 400	93.973	-1 4	0.00	0 00	0.14	0.10	0.00	0 00	N18	-0 14	-0 10	265	80.00	
N666	Load	0 400	95 683	-1.0	0 00	0 00	0.10	0.08	0.00	0 00	N6	-0 10	-0 08	188	80.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# Bus2	0.400	97.125	0.389	* Bus5	0.400	94 256	0 377	# N18	6.000	97.879	5.873
# N19	6.000	97 830	5.870	# N55	0.400	97 046	0 388	# N66	0.400	95.683	0.383
*N188	0.400	93.973	0.376	# N666	0.400	95 683	0 383				

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.315	0.177	56.20	0.173	54.99
T3	Transformer				0.200	0.129	64.31	0.125	62.50
T4	Transformer				0.200	0.129	64.31	0.125	62.50
T6	Transformer				0.200	0.056	28.06	0.055	27.71
T8	Transformer				0.200	0.180	90.07	0.173	86.50
T10	Transformer				0.200	0.180	90.10	0.173	86.50

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	
T6	Bus2	N11	0.0	0.0	0.0	0.0	0.3	0.8	97.1	98.3	
T8	Bus5	N13	-0.1	-0.1	0.1	0.1	2.9	7.9	94.3	98.2	
N1 N2	N1	N2	2.5	1.3	-2.5	-1.3	0.5	0.2	100.0	100.0	
N2 N3	N2	N3	0.6	0.3	-0.6	-0.3	3.5	-10.8	100.0	99.4	
N2 N6	N2	N6	1.9	1.0	-1.8	-1.0	28.2	6.0	100.0	98.4	
N3 N4	N3	N4	0.0	0.0	0.0	0.0	0.0	-0.1	99.4	99.4	
N3 N5	N3	N5	0.1	0.1	-0.1	-0.1	0.3	-13.1	99.4	99.2	
T1	N5	N55	0.1	0.1	-0.1	-0.1	1.4	4.8	99.2	97.0	
N6 N15	N6	N15	0.8	0.3	-0.8	-0.3	0.6	-0.4	98.4	98.4	
N6 N7	N6	N7	0.0	0.0	0.0	0.0	0.0	-0.1	98.4	98.4	
N6 N8	N6	N8	0.7	0.5	-0.7	-0.5	0.2	-0.4	98.4	98.4	
T3	N6	N66	0.1	0.1	-0.1	-0.1	1.5	4.0	98.4	95.7	
T4	N6	N666	0.1	0.1	-0.1	-0.1	1.5	4.0	98.4	95.7	
N8 N9	N8	N9	0.3	0.2	-0.3	-0.2	0.1	-0.6	98.4	98.4	
N9 N10	N9	N10	0.2	0.2	-0.2	-0.2	0.1	-1.3	98.4	98.4	
N10 N11	N10	N11	0.0	0.0	0.0	0.0	0.0	-1.6	98.4	98.3	
N10 N12	N10	N12	0.2	0.1	-0.2	-0.1	0.1	-0.6	98.4	98.3	
N12 N13	N12	N13	0.1	0.1	-0.1	-0.1	0.3	-1.7	98.3	98.2	
N13 N14	N13	N14	0.0	0.0	0.0	0.0	0.0	-0.1	98.2	98.2	
N15 N16	N15	N16	0.5	0.2	-0.5	-0.2	0.2	-0.6	98.4	98.3	
N16 N17	N16	N17	0.4	0.2	-0.4	-0.2	1.0	-0.5	98.3	98.1	
N16 N20	N16	N20	0.1	0.0	-0.1	-0.1	0.0	-2.6	98.3	98.3	
N17 N18	N17	N18	0.3	0.1	-0.3	-0.1	0.9	-0.9	98.1	97.9	
N18 N19	N18	N19	0.2	0.0	-0.2	0.0	0.1	-0.4	97.9	97.8	
T10	N18	N188	0.1	0.1	-0.1	-0.1	3.0	7.9	97.9	94.0	
N20 N21	N20	N21	0.0	0.0	0.0	0.0	0.0	-1.8	98.3	98.3	
							46.8	-1.9			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	*0.00*	*0.00*	*0.00*

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	2.452	1.300	2.775	88.36 Lagging
Generators:	000	0.000	0.000	100.00 Lagging
Total Demand	2.452	1.300	2.775	88.36 Lagging
Total Motor Load:	2.404	1.301	2.734	87.95 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.048	-0.001		
System Mismatch:	0.001	0.001		

Number of Iterations: 2

National Insulated Cable (Bhatpara D/S)

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	2	3

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	0	0	0	2	0	0	2

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.000100 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename: BHATPARA

Output Filename: C:\ETAPS\PowerStn\Bhatpara-6kv\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0			1.320	0.479				
N3	Load	6.00	100.0	0.0			0.338	0.144				
3 Buses Total					0.000	0.000	1.657	0.623	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	**ohms / 1000 m per Conductor (Cable) or per Phase (Line)**							
ID	**Library**	**Size**	**L(m)**	**#/ph**	**T (C)**	**R**	**X**	**Y**
N1 N2			2926.0	1	75	14602	08055	0001770
N2 N3			299.0	1	75	.14479	08100	0001720

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*						

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter. Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
N1 N2	Line/Cable	N1	N2	118.68	65.47	135.54	0 0186445
N2 N3	Line/Cable	N2	N3	12.03	6 73	13.78	0 0018514

EQUIPMENT CABLE Input Data

Cable	**Connection**			**ohms / 1000 m per Conductor**								**H**
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
*N1	Swng	6.000	100.000	0.0	1.70	0.62	0.00	0.00	0.00	0.00	N2	1.70	0.62	173	93.84	
N2	Load	6.000	97.572	-0.2	0.00	0.00	1.32	0.48	0.00	0.00	N1	-1.66	-0.62	174	93.64	
											N3	0.34	0.14	36	92.17	
N3	Load	6.000	97.521	-0.2	0.00	0.00	0.34	0.14	0.00	0.00	N2	-0.34	-0.14	36	92.00	

* A regulate (constant kV) bus

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltage**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# N2	6.000	97.572	5.854	# N3	6.000	97.521	5.851				

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltag**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage	
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To
N1 N2	N1	N2	1.7	0.6	-1.7	-0.6	38.9	3.3	100.0	97.6
N2 N3	N2	N3	0.3	0.1	-0.3	-0.1	0.2	-1.7	97.6	97.5
							39.1	1.6		

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es)	1.696	0.624	1.808	93.84 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	1.696	0.624	1.808	93.84 Lagging
Total Motor Load:	1.657	0.623	1.771	93 61 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.039	0.002		
System Mismatch.	0.000	0.000		

Number of Iterations: 2

United Bank of India F2 (Prinsep St. D/S)

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses	1	0	17	18

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches	5	0	0	12	0	0	17

Method of Solution. Newton-Raphson Method

Maximum Number of Iteration 5

Precision of Solution 0.001000 MW and Mvar

System Frequency 50 00

Unit System Metric

Project Filename CESC1

Output Filename C:\ETAPS\PowerStn\United Bank 6 KV\Untitled lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limi	
ID	Type	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Bus7	Load	0.40	100.0	0.0			0.139	0.104				
N1	SWNG	6.00	100.0	0.0								
N2	Load	6.00	100.0	0.0			1.314	0.599				
N3	Load	6.00	100.0	0.0			0.471	0.378				
N4	Load	6.00	100.0	0.0			0.103	0.091				
N5	Load	6.00	100.0	0.0								
N6	Load	6.00	100.0	0.0								
N7	Load	6.00	100.0	0.0								
N8	Load	6.00	100.0	0.0								
N9	Load	6.00	100.0	0.0			0.378	0.303				
N10	Load	6.00	100.0	0.0			0.185	0.134				
N11	Load	6.00	100.0	0.0								
N12	Load	6.00	100.0	0.0								
N13	Load	6.00	100.0	0.0			0.197	0.158				
N55	Load	0.40	100.0	0.0			0.050	0.037				
N66	Load	0.40	100.0	0.0			0.161	0.121				
N77	Load	0.40	100.0	0.0			0.200	0.150				
N111	Load	0.40	100.0	0.0			0.255	0.191				
18 Buses Total					0.000	0.000	3.451	2.265	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N1 N2			1218.0	1	75	14729	08000	0001820
N11 N12			34.0	1	75	74765	09421	0001140
N12 N13			80.0	1	75	74765	09421	0001110
N2 N3			78.0	1	75	16621	07790	0002030
N3 N4			42.0	1	75	89780	10598	0000790
N3 N7			52.0	1	75	46836	09347	0001120
N4 N5			184.0	1	75	88311	10483	0000830
N5 N6			196.0	1	75	.89780	10598	0000810
N7 N8			144.0	1	75	.39267	08932	0001330
N8 N11			54.0	1	75	74765	09421	0001130
N8 N9			9.0	1	75	48182	.09421	0001230
N9 N10			100.0	1	75	74765	09421	.0001110

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T5	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T7	0.315	6.000	0.400	4.800	3.3	0.000	0.000	0.00
T9	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim Bus ID	Sec. Bus ID	Ter. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N5	N55	454.02	1520.98	1587.30	
T3	2W XFMR	N6	N66	454.02	1520.98	1587.30	
T5	2W XFMR	N7	N77	454.02	1520.98	1587.30	
T7	2W XFMR	N11	N111	435.86	1460.14	1523.81	
T9	2W XFMR	N12	Bus7	454.02	1520.98	1587.30	
N1 N2	Line/Cable	N1	N2	49.83	27.07	56.71	0.0079803
N2 N3	Line/Cable	N2	N3	3.60	1.69	3.98	0.0005700
N3 N4	Line/Cable	N3	N4	10.47	1.24	10.55	0.0001194
N3 N7	Line/Cable	N7	N3	6.77	1.35	6.90	0.0002097
N4 N5	Line/Cable	N4	N5	45.14	5.36	45.45	0.0005498
N5 N6	Line/Cable	N5	N6	48.88	5.77	49.22	0.0005715
N7 N8	Line/Cable	N8	N7	15.71	3.57	16.11	0.0006895
N8 N11	Line/Cable	N11	N8	11.21	1.41	11.30	0.0002197
N8 N9	Line/Cable	N8	N9	1.20	0.24	1.23	0.0000399
N9 N10	Line/Cable	N9	N10	20.77	2.62	20.93	0.0003996
N11 N12	Line/Cable	N12	N11	7.06	0.89	7.12	0.0001395
N12 N13	Line/Cable	N13	N12	16.61	2.09	16.75	0.0003197

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus7	Load	0 400	0 379	-0 8	0 00	0 00	0 14	0 10	0 00	0 00	N12	-0.14	-0 10	264	80 00	
*N1	Swng	6 000	6 000	0 0	3 57	2.35	0 00	0 00	0 00	0 00	N2	3.57	2.35	410	83.53	
N2	Load	6 000	5 855	0 1	0 00	0 00	1.31	0 60	0 00	0 00	N1	-3.47	-2.31	411	83 33	
											N3	2.16	1 71	271	78 47	
N3	Load	6 000	5 849	0 1	0 00	0 00	0 47	0.38	0.00	0 00	N2	-2.16	-1 71	271	78 45	
											N4	0.32	0.26	40	77 85	
											N7	1.37	1 07	171	78.74	
N4	Load	6 000	5 846	0 2	0 00	0.00	0.10	0.09	0 00	0 00	N3	-0.32	-0 26	40	77.82	
											N5	0.21	0.16	26	79.20	
N5	Load	6 000	5 840	0.2	0 00	0 00	0.00	0 00	0 00	0 00	N4	-0.21	-0.16	26	79.07	
											N6	0.16	0 13	20	78.90	
											N55	0.05	0 04	6	79.62	
N6	Load	6 000	5 835	0 2	0 00	0 00	0 00	0 00	0 00	0 00	N5	-0.16	-0.13	20	78.74	
											N66	0.16	0.13	20	78.74	
N7	Load	6 000	5 842	0 2	0 00	0 00	0 00	0 00	0.00	0.00	N3	-1.37	-1 07	171	78.70	
											N8	1.17	0.91	146	78.75	
											N77	0.20	0.16	25	78.43	
N8	Load	6 000	5 829	0 2	0 00	0 00	0 00	0 00	0 00	0 00	N7	-1.16	-0 91	146	78 66	
											N11	0.60	0 48	75	78.30	
											N9	0.56	0 44	70	79 03	
N9	Load	6 000	5 828	0 2	0 00	0 00	0 38	0 30	0 00	0 00	N8	-0.56	-0 44	70	79.03	
											N10	0.18	0 13	22	81 09	
N10	Load	6 000	5 826	0 2	0 00	0 00	0 18	0 13	0.00	0.00	N9	-0.18	-0 13	22	81.00	
N11	Load	6 000	5 824	0 3	0.00	0 00	0 00	0.00	0 00	0 00	N8	-0.60	-0.48	75	78.26	
											N12	0.34	0.27	42	78.45	
											N111	0.26	0.21	33	78 03	
N12	Load	6.000	5.823	0.3	0.00	0 00	0 00	0 00	0.00	0.00	N11	-0.34	-0.27	42	78.42	
											N13	0.20	0.16	25	78.08	
											Bus7	0.14	0.11	17	78.92	
N13	Load	6 000	5.820	0.3	0.00	0.00	0.20	0.16	0 00	0 00	N12	-0.20	-0.16	25	78.01	
N55	Load	0.400	0.386	-0.2	0.00	0.00	0.05	0.04	0 00	0.00	N5	-0.05	-0.04	93	80.00	
N66	Load	0.400	0.378	-1.0	0 00	0.00	0.16	0.12	0.00	0.00	N6	-0.16	-0.12	306	80.00	
N77	Load	0.400	0.376	-1.3	0.00	0.00	0 20	0.15	0 00	0.00	N7	-0.20	-0.15	383	80.00	
N111	Load	0.400	0.371	-1.6	0.00	0.00	0.26	0.19	0.00	0.00	N11	-0.26	-0.19	496	80.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 90 % - Marginal Limit = 85 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 110 % - Marginal Limit = 120 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.315	0.063	19.96	0.062	19.79
T3	Transformer				0.315	0.207	65.63	0.201	63.78
T5	Transformer				0.315	0.258	82.06	0.249	79.18
•T7	Transformer				0.315	0.334	105.92	0.319	101.27
T9	Transformer				0.315	0.178	56.35	0.173	54.99

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	in
T9	Bus7	N12	-0.1	-0.1	0.1	0.1	1.5	5.1	94.7	97.0	
N1 N2	N1	N2	3.6	2.3	-3.5	-2.3	90.9	41.6	100.0	97.6	
N2 N3	N2	N3	2.2	1.7	-2.2	-1.7	2.9	0.8	97.6	97.5	
N3 N4	N3	N4	0.3	0.3	-0.3	-0.3	0.2	-0.1	97.5	97.4	
N3 N7	N3	N7	1.4	1.1	-1.4	-1.1	2.2	0.2	97.5	97.4	
N4 N5	N4	N5	0.2	0.2	-0.2	-0.2	0.3	-0.5	97.4	97.3	
N5 N6	N5	N6	0.2	0.1	-0.2	-0.1	0.2	-0.5	97.3	97.2	
T1	N5	N55	0.1	0.0	0.0	0.0	0.2	0.6	97.3	96.5	
T3	N6	N66	0.2	0.1	-0.2	-0.1	2.1	6.9	97.2	94.5	
N7 N8	N7	N8	1.2	0.9	-1.2	-0.9	3.6	0.2	97.4	97.1	
T5	N7	N77	0.2	0.2	-0.2	-0.1	3.2	10.7	97.4	93.9	
N8 N11	N8	N11	0.6	0.5	-0.6	-0.5	0.7	-0.1	97.1	97.1	
N8 N9	N8	N9	0.6	0.4	-0.6	-0.4	0.1	0.0	97.1	97.1	
N9 N10	N9	N10	0.2	0.1	-0.2	-0.1	0.1	-0.4	97.1	97.1	
N11 N12	N11	N12	0.3	0.3	-0.3	-0.3	0.1	-0.1	97.1	97.0	
T7	N11	N111	0.3	0.2	-0.3	-0.2	5.1	17.2	97.1	92.8	
N12 N13	N12	N13	0.2	0.2	-0.2	-0.2	0.1	-0.3	97.0	97.0	
							113.5	81.4			

EQUIPMENT CABLE LOSSES Summary Report

Cable	**Connection**			***Losses***		**% Voltage**		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es)	3.565	2.347	4.268	83.53 Lagging
Generators:	000	0.000	0.000	100.00 Lagging
Total Demand.	3.565	2.347	4 268	83.53 Lagging
Total Motor Load:	3.452	2.265	4.129	83.61 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses.	0.114	0.082		
System Mismatch:	0.002	0.000		

Number of Iterations: 2

Project	PowerStation 3.0.1C	Page:	1
Location		Date:	11-13-2001
Contract:		SN:	TATAENERGY
Engineer	Study Case LF	Revision:	Base
Filename **Lake North T/H (Ritchie D/S)**		Config.	Normal

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Normal

Normal Loading

	Swing	Generator	Load	Total
Number of Buses.	1	0	19	20

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	9	0	0	11	0	0	20

Method of Solution. Gauss-Seidel Method

Maximum Number of Iteration: 9000

Precision of Solution 0.000000

Load Flow Acceleration Factor 1.45

System Frequency 50 00

Unit System Metric

Project Filename RITCHIE

Output Filename. C:\ETAPS\PowerStn\Ritchie-6kv\Untitled.lf1

Project:	**PowerStation**	Page:	2
Location:	3.0.1C	Date.	01-18-2002
Contract:		SN:	TATAENERGY
Engineer:	Study Case: **LF**	Revision:	Base
Filename: RITCHIE		Config.:	Normal

BUS Input Data

Bus Info. & Nominal kV			**Initial Voltage**		**Generator**		**Motor Load**		**Static Load**		**Mvar Limit**	
ID	Type	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	Max	Mi
Bus2	Load	6.00	100.0	0.0								
Bus3	Load	0.40	100.0	0.0			0.188	0.141				
Bus4	Load	0.40	100.0	0.0			0.166	0.125				
Bus5	Load	0.40	100.0	0.0			0.152	0.114				
Bus6	Load	0.40	100.0	0.0			0.527	0.395				
Bus7	Load	0.40	100.0	0.0			0.111	0.083				
Bus9	Load	0.40	100.0	0.0			0.111	0.083				
Bus10	Load	0.40	100.0	0.0			0.166	0.125				
N1	SWNG	6.00	100.0	0.0								
N3	Load	6.00	100.0	0.0								
N4	Load	6.00	100.0	0.0			0.029	0.004				
N5	Load	6.00	100.0	0.0								
N6	Load	6.00	100.0	0.0								
N7	Load	6.00	100.0	0.0								
N8	Load	6.00	100.0	0.0								
N9	Load	6.00	100.0	0.0								
N10	Load	6.00	100.0	0.0								
N11	Load	6.00	100.0	0.0								
N12	Load	6.00	100.0	0.0								
Panditya	Load	0.40	100.0	0.0			0.139	0.104				
20 Buses Total					0.000	0.000	1.590	1.175	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
N10 N11			313.0	1	75	12046	07898	0001890
N11 N12			171.0	1	75	12046	07898	0001880
N1-N2			323.0	1	75	23057	08106	0001720
N2-N3			113.0	1	75	48182	09421	0001110
N2-N6			200.0	1	75	.20874	08065	0001750
N3 N4			60.0	1	75	.48182	09421	0001110
N3 N5			65.0	1	75	48182	.09421	0001110
N6 N7			138.0	1	75	.17608	08003	.0001810
N7 N8			375.0	1	75	24021	08124	.0001700
N8 N10			373.0	1	75	.12046	07898	0001890
N8 N9			179.0	1	75	24091	08640	.0001410

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.
T1	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T2	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T3	0.315	6.000	0.400	5.000	2.7	0.000	0.000	0.00
T4	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T5	0.400	6.000	0.400	5.000	3.2	0.000	0.000	0.00
T6	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T8	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T9	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00
T11	0.315	6.000	0.400	5.000	3.3	0.000	0.000	0.00

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						

REACTOR Input Data

Reactor	**Connected Buses**		**Impedance**		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
T1	2W XFMR	N6	Panditiya	454 02	1520.98	1587.30	
T2	2W XFMR	N5	Bus3	454 02	1520.98	1587.30	
T3	2W XFMR	N7	Bus4	554.91	1487.15	1587 30	
T4	2W XFMR	N9	Bus5	454.02	1520.98	1587.30	
T5	2W XFMR	N8	Bus6	374 98	1192.43	1250.00	
T6	2W XFMR	N10	Bus7	454.02	1520.98	1587.30	
T8	2W XFMR	N11	Bus9	454.02	1520.98	1587.30	
T9	2W XFMR	N12	Bus10	454.02	1520.98	1587.30	
T11	2W XFMR	N8	Bus6	454.02	1520.98	1587.30	
N1-N2	Cable	N1	Bus2	20.69	7.27	21.93	0.0020000
N2-N3	Cable	N3	Bus2	15.12	2.96	15.41	0 0004515
N2-N6	Cable	Bus2	N6	11.60	4.48	12.43	0.0012600
N3 N4	Cable	N3	N4	8.03	1.57	8.18	0 0002398
N3 N5	Cable	N3	N5	8.70	1.70	8.86	0 0002597
N6 N7	Cable	N6	N7	6.75	3.07	7.41	0.0008992
N7 N8	Cable	N7	N8	25.02	8.46	26.41	0 0022950
N8 N10	Cable	N8	N10	12.48	8.18	14 92	0 0025379
N8 N9	Cable	N9	N8	11.98	4.30	12.73	0.0009086
N10 N11	Cable	N11	N10	10.47	6.87	12.52	0 0021297
N11 N12	Cable	N12	N11	5 72	3.75	6.84	0 0011573

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								C He
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow				
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF
Bus2	Load	6.000	5.974	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N1	-1.62	-1.24	197	79.48
											N3	0.22	0.15	25	81.99
											N6	1.40	1.09	171	79.08
Bus3	Load	0.400	0.385	-1.2	0.00	0.00	0.19	0.14	0.00	0.00	N5	-0.19	-0.14	352	80.00
Bus4	Load	0.400	0.385	-0.9	0.00	0.00	0.17	0.12	0.00	0.00	N7	-0.17	-0.12	311	80.00
Bus5	Load	0.400	0.385	-0.9	0.00	0.00	0.15	0.11	0.00	0.00	N9	-0.15	-0.11	285	80.00
Bus6	Load	0.400	0.380	-1.5	0.00	0.00	0.53	0.39	0.00	0.00	N8	-0.30	-0.22	559	80.38
											N8	-0.23	-0.18	440	79.51
Bus7	Load	0.400	0.388	-0.6	0.00	0.00	0.11	0.08	0.00	0.00	N10	-0.11	-0.08	206	80.00
Bus9	Load	0.400	0.388	-0.6	0.00	0.00	0.11	0.08	0.00	0.00	N11	-0.11	-0.08	206	80.00
Bus10	Load	0.400	0.384	-1.0	0.00	0.00	0.17	0.12	0.00	0.00	N12	-0.17	-0.12	312	80.00
*N1	Swng	6.000	6.000	0.0	1.63	1.24	0.00	0.00	0.00	0.00	Bus2	1.63	1.24	197	79.61
N3	Load	6.000	5.972	0.1	0.00	0.00	0.00	0.00	0.00	0.00	Bus2	-0.22	-0.15	25	81.91
											N4	0.03	0.00	2	99.10
											N5	0.19	0.15	23	78.66
N4	Load	6.000	5.972	0.1	0.00	0.00	0.03	0.00	0.00	0.00	N3	-0.03	0.00	2	98.99
N5	Load	6.000	5.971	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N3	-0.19	-0.15	23	78.60
											Bus3	0.19	0.15	23	78.59
N6	Load	6.000	5.962	0.1	0.00	0.00	0.00	0.00	0.00	0.00	Bus2	-1.40	-1.09	171	79.01
											N7	1.26	0.98	154	79.01
											Panditiya	0.14	0.11	17	78.97
N7	Load	6.000	5.955	0.1	0.00	0.00	0.00	0.00	0.00	0.00	N6	-1.26	-0.98	154	78.97
											N8	1.09	0.85	133	78.99
											Bus4	0.17	0.13	20	78.87
N8	Load	6.000	5.934	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N7	-1.08	-0.85	133	78.83
											N10	0.39	0.30	48	79.55
											N9	0.15	0.12	18	79.08
											Bus6	0.30	0.24	37	78.63
											Bus6	0.23	0.19	29	77.73
N9	Load	6.000	5.932	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N8	-0.15	-0.12	19	78.85
											Bus5	0.15	0.12	19	78.85
N10	Load	6.000	5.929	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N8	-0.39	-0.30	48	79.31
											N11	0.28	0.22	34	79.36
											Bus7	0.11	0.09	13	79.17
N11	Load	6.000	5.927	0.2	0.00	0.00	0.00	0.00	0.00	0.00	N10	-0.28	-0.22	34	79.08
											N12	0.17	0.13	20	79.01
											Bus9	0.11	0.09	13	79.17

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	kV	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
N12	Load	6 000	5 926	0 2	0 00	0 00	0 00	0 00	0 00	0 00	N11	-0.17	-0 13	20	78.75	
											Bus10	0.17	0 13	20	78.74	
Panditiva	Load	0 400	0 388	-0 9	0 00	0 00	0 14	0 10	0 00	0 00	N6	-0.14	-0 10	257	80 00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0 1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV
# Bus3	0.400	96.370	0.385	# Bus4	0.400	96.345	0.385	# Bus5	0.400	96.333	0.385
* Bus6	0.400	94.936	0.380	# Bus7	0.400	96.986	0.388	# Bus9	0.400	96.940	0.388
# Bus10	0.400	95.980	0.384	# Panditiya	0.400	97.069	0.388				

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%
T1	Transformer				0.315	0.177	56.28	0.173	54.99
T2	Transformer				0.315	0.243	77.22	0.236	74.78
T3	Transformer				0.315	0.214	67.97	0.208	65.98
T4	Transformer				0.315	0.196	62.08	0.191	60.48
T5	Transformer				0.400	0.384	95.90	0.368	92.06
T6	Transformer				0.315	0.142	44.96	0.139	44.13
T8	Transformer				0.315	0.142	44.96	0.139	44.13
T9	Transformer				0.315	0.214	67.90	0.208	65.98
T11	Transformer				0.315	0.302	95.90	0.290	92.06

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		% m'
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	
N1-N2	Bus2	N1	-1.6	-1.2	1.6	1.2	8.7	1.1	99.6	100.0	
N2-N3	Bus2	N3	0.2	0.2	-0.2	-0.2	0.1	-0.4	99.6	99.5	
N2-N6	Bus2	N6	1.4	1.1	-1.4	-1.1	3.7	0.2	99 6	99 4	
T2	Bus3	N5	-0.2	-0.1	0.2	0.2	2.7	9.1	96.4	99.5	
T3	Bus4	N7	-0.2	-0.1	0.2	0.1	2.6	6.9	96.3	99.2	
T4	Bus5	N9	-0.2	-0.1	0.2	0.1	1.8	5.9	96.3	98.9	
T5	Bus6	N8	-0.3	-0.2	0.3	0.2	5.6	17.9	94 9	98.9	
T11	Bus6	N8	-0.2	-0.2	0.2	0.2	4.2	14.2	94.9	98.9	
T6	Bus7	N10	-0.1	-0.1	0.1	0.1	0.9	3.1	97.0	98.8	
T8	Bus9	N11	-0.1	-0.1	0.1	0.1	0.9	3.1	96.9	98 8	
T9	Bus10	N12	-0.2	-0.1	0.2	0.1	2.1	7.1	96.0	98.8	
N3 N4	N3	N4	0.0	0.0	0.0	0.0	0.0	-0.2	99.5	99.5	
N3 N5	N3	N5	0.2	0.2	-0.2	-0.2	0.1	-0.2	99.5	99.5	
N6 N7	N6	N7	1.3	1.0	-1.3	-1.0	1.7	-0.1	99.4	99.2	
T1	N6	Panditiya	0.1	0.1	-0.1	-0.1	1.4	4.8	99.4	97.1	
N7 N8	N7	N8	1 1	0 8	-1.1	-0 8	4 8	-0.6	99 2	98 9	
N8 N10	N8	N10	0.4	0.3	-0.4	-0.3	0.3	-2.3	98.9	98.8	
N8 N9	N8	N9	0 2	0.1	-0.2	-0 1	0.0	-0 9	98 9	98 9	
N10 N11	N10	N11	0.3	0.2	-0.3	-0.2	0.1	-2.0	98.8	98 8	
N11 N12	N11	N12	0.2	0.1	-0 2	-0 1	0 0	-1 1	98 8	98 8	
							42 0	65.7			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	1.631	1.240	2.049	79.61 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand	1.631	1.240	2.049	79.61 Lagging
Total Motor Load:	1.590	1.175	1.977	80.42 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.042	0.065		
System Mismatch:	0.001	0.000		

Number of Iterations: 140

Annex 14

Load Flow Result of LT Networks

Dustribution Transformer: Akra Clony O/T

Akra D/S

	Rating	Initial Reading (25/6/2001)					Final Reading (27/7/2001)				Energy Advance			Total kWh
				Meter Reading				Meter Reading						
	(kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C	
Distribution Transformers														
2 Akra Colony O/T	315	10 42	60	2413	5510	5268		3372	6433	6269	960	923	1001	173010

Summary of energy audit result

Input to the LT network	(kWh)	162197	
Output energy recorded	(kWh)	58255	
Total enegy loss	(kWh)	103942	
Percentage loss	(%)	**64.1%**	
Technical losses			
U4 Lead Cable	(Kw)	0 0104	
U5 Lead Cable	(Kw)	0 5638	
U6 Lead Cable	(Kw)	1 6885	
U4 LT Service Lines	(Kw)	0 0009	
U5 LT Service Lines	(Kw)	0 0210	
U6 LT Service Lines	(Kw)	0 1030	
Loss in cable (400 mm2, 15m) connecting LT side of transformer and feeder Pillar E	(Kw)	0 0890	
	sub-total	2 4766	
load (this is winter load)		76 8037	kw
loss %		3 22%	
Peak load during study period i.e. month of May		300	kw
Peak loss during study period		38	kw
Study period		30	
LLF		0 48	
Energy loss (Technical)	(kWh)	13059	
	(%)	**8.1%**	
Energy Loss (Non-technical)	(kWh)	90883	
	(%)	**56.0%**	

Dustribution Transformer: Canning St. (W) P/T

		Initial Reading (14/8/2001)					Final Reading (16/8/2001)				Energy Advance			Total kWh	Total kWh prorated for 45 days
				Meter Reading				Meter Reading							
	Rating (kVA)	Time	MF	Phase A	Phase B	Phase C	Time	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C		
Distribution Transformers															
1 Canning St (W) P/T	600		60	1948	1680	1808		1970	1698	1826	22	18	18	3480	52200

Summary of energy audit result

Input to the LT network	(kWh)	52200
Total energy sold	(kWh)	47895
Total enegy loss	(kWh)	4305
Percentage loss	(%)	**8.2%**

Summary of Load Flow result

Swing Bus	(MW)	0 160
Generators	(MW)	0 000
Total operating Load	(MW)	0 157
Peak losses	(MW)	0 003
Study period		30
LLF		0 31
Energy loss (Technical)	(kWh)	670
	(%)	**1.3%**
Energy Loss (Non-technical)	(kWh)	3635
	(%)	**7.0%**

Dustribution Transformer: C.L. Missir Road T/H
Akra D/S

	Rating (kVA)	Initial Reading (28/6/2001)					Final Reading (28/7/2001)				Energy Advance			Total kWh
		Time	MF	Meter Reading			Time	Meter Reading						
				Phase A	Phase B	Phase C		Phase A	Phase B	Phase C	Phase A	Phase B	Phase C	
Distribution Transformers														
1 C.L. Missir Rd (E) T/H	315	12.10	60	1342	1442	1349	14:50	1509	1626	1503	167	184	154	30300

Summary of energy audit result		
Input to the LT network	(kWh)	30300
Total energy sold	(kWh)	25784
Total enegy loss	(kWh)	4516
Percentage loss	(%)	**14.9%**
Summary of Load Flow result		
Swing Bus	(MW)	0 227
Generators	(MW)	0 000
Total operating Load	(MW)	0 223
Peak losses	(MW)	0 004
Study penod		30
LLF		0 5
Energy loss (Technical)	(kWh)	1440
	(%)	**4.8%**
Energy Loss (Non-technical)	(kWh)	3076
	(%)	**10.2%**

Akra Colony O/T

Calculation of LT Distribution Loss (U4)

SVC .NO	From	To	SIZE (MM2)	Resistance (ohm/KM) Phase	Resistance (ohm/KM) Neutral	LENGTH (m)	Sum of currents in all the phases (amp)	Average current per phase (amp)	Power Loss (W)
1	Transformer	1	70	0.61	1.22	30	29.9	9.97	5.5
2	1	2	70	0.61	1.22	5	29.1	9.70	0.9
3	2	3	70	0.61	1.22	5	25.5	8.50	0.7
4	3	node	70	0.61	1.22	5	24.6	8.20	0.6
5	node	4	70	0.61	1.22	10	4.0	1.33	0.0
6	4	5	70	0.61	1.22	10	3.1	1.03	0.0
7	node	6	70	0.61	1.22	5	20.6	6.87	0.4
8	6	7	70	0.61	1.22	4	19.7	6.57	0.3
9	7	8	70	0.61	1.22	5	18.8	6.27	0.4
10	8	9	70	0.61	1.22	5	17.8	5.93	0.3
11	9	10	70	0.61	1.22	5	15.1	5.03	0.2
12	10	11	70	0.61	1.22	6	13.9	4.63	0.2
13	11	12	70	0.61	1.22	5	13.0	4.33	0.2
14	12	13	70	0.61	1.22	6	12.1	4.03	0.2
15	13	14	70	0.61	1.22	6	11.3	3.77	0.2
16	14	15	70	0.61	1.22	5	10.6	3.53	0.1
17	15	16	70	0.61	1.22	5	9.7	3.23	0.1
18	16	17	70	0.61	1.22	5	6.4	2.13	0.0
19	17	18	70	0.61	1.22	6	5.3	1.77	0.0
20	18	19	70	0.61	1.22	5	4.5	1.50	0.0
21	19	20	70	0.61	1.22	6	3.6	1.20	0.0
22	19	21	70	0.61	1.22	5	0.8	0.27	0.0
							Power loss in the main cable U4		**10.4**

Akra Colony O/T

Calculation of LT Distribution Loss (U5)

SVC .NO	From	To	SIZE (MM2)	Resistance (ohm/KM) Phase	Resistance (ohm/KM) Neutral	LENGTH (m)	Sum of currents in all the phases (amp)	Average current per phase (amp)	Power Loss (Watts)
1	U5	47/31/4	240	0.17	0.34	184	136	45.4	193.42
2	47/14	47/13	240	0.17	0.34	30	134	44.8	30.71
3	47/13	47/12	240	0.17	0.34	28	131	43.7	27.27
4	47/12	47/11	240	0.17	0.34	28	129	42.9	26.24
5	47/11	47/10	240	0.17	0.34	30	126	42.0	26.99
6	47/10	47/9	240	0.17	0.34	32	125	41.7	28.38
7	47/9	47/8	240	0.17	0.34	28	123	40.9	23.93
8	47/8	47/7	240	0.17	0.34	30	120	40.0	24.48
9	47/7	47/6	240	0.17	0.34	31	116	38.6	23.76
10	47/6	47/5	240	0.17	0.34	29	113	37.8	21.10
11	47/5	47/4	240	0.17	0.34	30	111	37.1	21.06
12	47/4	47/3	240	0.17	0.34	28	109	36.5	18.99
13	47/3	47/2	240	0.17	0.34	30	106	35.5	19.25
14	47/2	47/1	240	0.17	0.34	29	104	34.7	17.84
15	47/1	22/4/1	240	0.17	0.34	31	95	31.5	15.69
16	22/4/1	22/4	240	0.17	0.34	27	90	29.9	12.31
17	22/4	22/3	240	0.17	0.34	29	49	16.4	3.99
18	22/3	22/2	240	0.17	0.34	30	45	15.0	3.44
19	22/2	22/1	240	0.17	0.34	30	3	1.0	0.02
20	22/2	23/1	240	0.17	0.34	30	40	13.4	2.76
21	23/1	77a	240	0.17	0.34	12	37	12.4	0.95
22	77a	23/2	240	0.17	0.34	16	37	12.4	1.26
23	23/2	23/3	240	0.17	0.34	29	24	8.0	0.95
24	23/3	23/4	240	0.17	0.34	30	23	7.7	0.90
25	23/4	23/5	240	0.17	0.34	30	17	5.6	0.49
26	23/5	23/6	240	0.17	0.34	29	15	5.0	0.37
27	23/6	23/7	240	0.17	0.34	28	13	4.4	0.27
28	23/7	95	240	0.17	0.34	30	8	2.7	0.11
29	94	96/97	240	0.17	0.34	30	7	2.3	0.08
30	96/97	98/99/100	240	0.17	0.34	30	5	1.6	0.04
31	98/99/100	101/101a	240	0.17	0.34	31	2	0.6	0.01
32	22/4	110d	240	0.17	0.34	5	34	11.3	0.33
33	110d	110c	240	0.17	0.34	5	34	11.3	0.33
34	110c	110b	240	0.17	0.34	6	33	11.0	0.37
35	110b	110a	240	0.17	0.34	8	32	10.7	0.47
36	110a	22/4/0	240	0.17	0.34	5	31	10.4	0.28
37	22/4/0	22/4/0/1	240	0.17	0.34	30	29	9.8	1.47
38	22/4/0/1	22/4/0/2	240	0.17	0.34	30	28	9.2	1.29
39	22/4/0/2	22/4/0/4	240	0.17	0.34	59	27	8.8	2.35
40	22/4/0/4	22/4/0/5	240	0.17	0.34	30	26	8.5	1.11
41	22/4/0/5	22/4/0/6	240	0.17	0.34	29	23	7.6	0.86
42	22/4/0/6	22/4/0/7	240	0.17	0.34	30	20	6.8	0.71
43	22/4/0/7	124a	240	0.17	0.34	36	19	6.2	0.71
44	124a	22/4/0/9	240	0.17	0.34	25	18	6.0	0.45
45	22/4/0/9	22/4/0/9/1	240	0.17	0.34	30	9	3.0	0.14
46	22/4/0/9/1	22/4/0/9/3	240	0.17	0.34	32	8	2.7	0.12
47	22/4/9/3	22/4/0/9/9	240	0.17	0.34	32	7	2.3	0.09
48	22/4/9/9	22/4/0/9/10	240	0.17	0.34	30	6	1.9	0.06
49	22/4/9/10	22/4/0/9/11	240	0.17	0.34	33	4	1.4	0.03
50	22/4/0/9/11	22/4/0/9/12	240	0.17	0.34	31	3	1.1	0.02
51	22/4/0/9/12	22/4/0/9/12	240	0.17	0.34	32	2	0.5	0.00
52	22/4/0/9	22/4/0/10	240	0.17	0.34	30	8	2.6	0.11
53	22/4/0/10	22/4/0/11	240	0.17	0.34	31	6	2.1	0.07
54	22/4/11/	22/4/0/3	240	0.17	0.34	61	4	1.4	0.06
55	23/4	86	25	1.64	3.28	30	3	0.8	0.10
56	86	87	25	1.64	3.28	5	2	0.5	0.01
57	87	8 8	25	1.64	3.28	10	1	0.2	0.00
58	85	84	25	1.64	3.28	10	1	0.3	0.00
59	84	83	25	1.64	3.28	10	2	0.7	0.02
60	83	82	25	1.64	3.28	37	3	0.9	0.15
61	82	23/4	25	1.64	3.28	25	4	1.2	0.18
62	109	108	70	0.605	1.21	5	1	0.3	0.00
63	108	107	70	0.605	1.21	6	2	0.6	0.00
64	107	106	70	0.605	1.21	6	3	0.9	0.01
65	106	105	70	0.605	1.21	5	4	1.2	0.01
66	105	104	70	0.605	1.21	4	5	1.5	0.02
67	104	103	70	0.605	1.21	5	5	1.7	0.03
68	103	102	70	0.605	1.21	5	6	2.1	0.04
69	102	23/7	70	0.605	1.21	30	7	2.4	0.31
							Power loss in the main cable U5		**559.3**

Akra Colony O/T

Calculation of LT Distribution Loss (U6)

SVC .NO	From	To	SIZE (MM2)	Resistance (ohm/KM) Phase	Resistance (ohm/KM) Neutral	LENGTH (m)	Sum of currents in all the phases (amp)	Average current per phase (amp)	Power Loss (Watts)
1	377	-	70	0.61	1.21	5	1.00	0.33	0.00
2		370	70	0.61	1.21	5	5.50	1.83	0.03
3	370	371	70	0.61	1.21	6	4.70	1.57	0.03
4	371	372	70	0.61	1.21	8	3.90	1.30	0.02
5	372	379	70	0.61	1.21	5	3.10	1.03	0.01
6	379	374	70	0.61	1.21	8	2.30	0.77	0.01
7	374	375	70	0.61	1.21	6	1.50	0.50	0.00
8	375	376	70	0.61	1.21	10	0.70	0.23	0.00
9			70	0.61	1.21	10	6.50	2.17	0.09
10	369	368	70	0.61	1.21	5	0.80	0.27	0.00
11	368	-	70	0.61	1.21	15	1.60	0.53	0.01
12	367	366	70	0.61	1.21	8	1.00	0.33	0.00
13	366	365	70	0.61	1.21	6	1.90	0.63	0.00
14	365	364	70	0.61	1.21	5	2.60	0.87	0.01
15	364	-	70	0.61	1.21	6	3.30	1.10	0.01
16	-	369	70	0.61	1.21	5	4.90	1.63	0.02
17	369	-	70	0.61	1.21	8	5.70	1.90	0.05
18	-	362	70	0.61	1.21	5	12.20	4.07	0.15
19	362	361	70	0.61	1.21	8	13.00	4.33	0.27
20	361	360	70	0.61	1.21	10	13.80	4.60	0.38
21	360	359	70	0.61	1.21	8	14.60	4.87	0.34
22	359	358	70	0.61	1.21	10	15.50	5.17	0.48
23	358	357	70	0.61	1.21	6	16.50	5.50	0.33
24	357	356	70	0.61	1.21	5	17.50	5.83	0.31
25	356	355	70	0.61	1.21	10	18.60	6.20	0.70
26	355	354	70	0.61	1.21	5	19.30	6.43	0.38
27	354	353	70	0.61	1.21	5	20.30	6.77	0.42
28	353	-	70	0.61	1.21	10	21.10	7.03	0.90
29	352	351	70	0.61	1.21	30	0.70	0.23	0.00
30	351	350	70	0.61	1.21	10	1.50	0.50	0.00
31	350	349	70	0.61	1.21	10	2.30	0.77	0.01
32	349	-	70	0.61	1.21	60	3.00	1.00	0.11
33	-	13/6	240	0.17	0.34	130	24.10	8.03	4.28
34	13/16	47/3/4	240	0.17	0.34	90	254.3	84.77	329.81
35	13/16	13/18	240	0.17	0.34	53	230.20	76.73	159.15
36	13/18	13/19	240	0.17	0.34	30	228.40	76.13	88.68
37	13/19	13/20	240	0.17	0.34	28	204.70	68.23	66.48
38	13/20	13/21	240	0.17	0.34	30	180.60	60.20	55.45
39	13/19	-	70	0.61	1.21	60	21.90	7.30	5.80
40	-	150	70	0.61	1.21	10	3.20	1.07	0.02
41	150	149	70	0.61	1.21	20	2.10	0.70	0.02
42	149	148	70	0.61	1.21	15	1.00	0.33	0.00
43	-	151	70	0.61	1.21	10	18.70	6.23	0.71
44	151	157	70	0.61	1.21	10	17.60	5.87	0.62
45	157	152	70	0.61	1.21	10	17.00	5.67	0.58
46	152	156	70	0.61	1.21	8	15.00	5.00	0.36
47	156	153	70	0.61	1.21	8	12.40	4.13	0.25
48	153	159	70	0.61	1.21	8	8.90	2.97	0.13
49	159	154	70	0.61	1.21	10	6.40	2.13	0.08
50	154	160	70	0.61	1.21	10	5.20	1.73	0.05
51	160	155	70	0.61	1.21	6	4.40	1.47	0.02
52	155	156	70	0.61	1.21	10	3.30	1.10	0.02
53	156	161	70	0.61	1.21	8	0.80	0.27	0.00
54	13/20	162	70	0.61	1.21	25	22.10	7.37	2.46
55	162	163	70	0.61	1.21	10	21.20	7.07	0.91
56	163	164	70	0.61	1.21	10	20.50	6.83	0.85
57	164	-	70	0.61	1.21	8	19.70	6.57	0.63
58	-	169	70	0.61	1.21	6	5.70	1.90	0.04
59	169	170	70	0.61	1.21	7	5.10	1.70	0.04
60	170	171	70	0.61	1.21	8	4.50	1.50	0.03
61	171	172	70	0.61	1.21	8	7.50	2.50	0.09
62	172	173	70	0.61	1.21	6	2.30	0.77	0.01
63	173	174	70	0.61	1.21	10	1.20	0.40	0.00
64	-	175	70	0.61	1.21	8	9.00	3.00	0.13
65	175	176	70	0.61	1.21	6	7.90	2.63	0.08
66	176	177	70	0.61	1.21	7	6.70	2.23	0.06
67	177	180	70	0.61	1.21	7	5.70	1.90	0.05
68	180	178	70	0.61	1.21	6	4.90	1.63	0.03
69	178	181	70	0.61	1.21	5	1.90	0.63	0.00
70	181	179	70	0.61	1.21	8	1.00	0.33	0.00
71	197	195	70	0.61	1.21	10	1.10	0.37	0.00
72	195	196	70	0.61	1.21	12	2.20	0.73	0.01
73	196	194	70	0.61	1.21	8	3.30	1.10	0.02
74	194	193	70	0.61	1.21	6	4.60	1.53	0.03

75	193	192	70	0.61	1.21	7	3.20	1.07	0.01
76	192	191	70	0.61	1.21	6	6.10	2.03	0.05
77	191	190	70	0.61	1.21	8	7.10	2.37	0.08
78	190	189	70	0.61	1.21	10	8.30	2.77	0.14
79	189	188	70	0.61	1.21	10	9.30	3.10	0.17
80	188	187	70	0.61	1.21	9	18.10	6.03	0.59
81	187	186	70	0.61	1.21	6	19.00	6.33	0.44
82	186	185	70	0.61	1.21	2	19.90	6.63	0.16
83	185	-	70	0.61	1.21	10	20.50	6.83	0.85
84	200	199	70	0.61	1.21	10	3.30	1.10	0.02
85	199	198	70	0.61	1.21	10	6.80	2.27	0.09
86	198	-	70	0.61	1.21	8	17.70	5.90	0.51
87	-	-	70	0.61	1.21	10	38.20	12.73	2.94
88	-	201	70	0.61	1.21	15	13.70	4.57	0.57
89	201	202	70	0.61	1.21	5	12.80	4.27	0.17
90	202	203	70	0.61	1.21	8	12.10	4.03	0.24
91	203	Mini PB	70	0.61	1.21	8	11.30	3.77	0.21
92	206	205	70	0.61	1.21	8	9.00	3.00	0.13
93	205	204	70	0.61	1.21	6	3.90	1.30	0.02
94	204	Mini PB	70	0.61	1.21	20	5.10	1.70	0.10
95	212	215	70	0.61	1.21	7	1.00	0.33	0.00
96	215	214	70	0.61	1.21	8	1.90	0.63	0.01
97	214	211	70	0.61	1.21	6	2.60	0.87	0.01
98	211	213	70	0.61	1.21	8	3.60	1.20	0.02
99	213	210	70	0.61	1.21	5	4.50	1.50	0.02
100	210	Mini PB	70	0.61	1.21	15	5.50	1.83	0.09
101	13/21	13/22	240	0.17	0.34	32	128.70	42.90	30.04
102	233	232	70	0.61	1.21	8	0.90	0.30	0.00
103	232	231	70	0.61	1.21	6	2.10	0.70	0.01
104	231	230	70	0.61	1.21	6	3.20	1.07	0.01
105	230	229	70	0.61	1.21	8	4.40	1.47	0.03
106	229	228	70	0.61	1.21	10	5.50	1.83	0.06
107	228	227	70	0.61	1.21	6	6.20	2.07	0.05
108	227	226	70	0.61	1.21	5	7.30	2.43	0.05
109	226	225	70	0.61	1.21	8	8.30	2.77	0.11
110	225	-	70	0.61	1.21	25	9.10	3.03	0.42
111	216	217	25	1.64	3.28	10	1.0	0.33	0.01
112	217	-	25	1.64	3.28	10	1.60	0.53	0.01
113	-	-	70	0.61	1.21	5	15.3	5.10	0.24
114	-	218	70	0.61	1.21	10	6.2	2.07	0.08
115	218	219	70	0.61	1.21	8	5.5	1.83	0.05
116	219	220	70	0.61	1.21	6	4.4	1.47	0.02
117	220	221	70	0.61	1.21	6	3.6	1.20	0.02
118	221	222	70	0.61	1.21	8	2.8	0.93	0.01
119	222	223	70	0.61	1.21	10	1.9	0.63	0.01
120	223	224	70	0.61	1.21	8	1	0.33	0.00
121	13/22	13/23	70	0.61	1.21	30	113.4	37.80	77.80
122	13/23	13/24	70	0.61	1.21	30	111.5	37.17	75.22
123	244	243	70	0.61	1.21	9	1	0.33	0.00
124	243	242	70	0.61	1.21	6	2	0.67	0.00
125	242	241	70	0.61	1.21	8	2.9	0.97	0.01
126	241	240	70	0.61	1.21	8	3.7	1.23	0.02
127	240	-	70	0.61	1.21	10	4.7	1.57	0.04
128	-	238	25	1.64	3.28	10	1.8	0.60	0.02
129	238	239	25	1.64	3.28	10	0.8	0.27	0.00
130	-	-	70	0.61	1.21	15	6.5	2.17	0.13
131	-	245	70	0.61	1.21	10	9.2	3.07	0.17
132	-	13/24	70	0.61	1.21	20	15.7	5.23	0.99
133	245	246	70	0.61	1.21	20	8.2	2.73	0.27
134	246	-	70	0.61	1.21	5	7.3	2.43	0.05
135	-	247	70	0.61	1.21	5	3.6	1.20	0.01
136	247	248	70	0.61	1.21	8	2.7	0.90	0.01
137	248	249	70	0.61	1.21	10	1.5	0.50	0.00
138	249	250	70	0.61	1.21	11	0.7	0.23	0.00
139	-	251	70	0.61	1.21	8	3.7	1.23	0.02
140	251	252	70	0.61	1.21	6	3.1	1.03	0.01
141	252	253	70	0.61	1.21	8	2.4	0.80	0.01
142	253	254	70	0.61	1.21	9	1.4	0.47	0.00
143	254	255	70	0.61	1.21	8	0.7	0.23	0.00
144	13/24	13/29	70	0.61	1.21	320	94.3	31.43	573.86
145	261	260	70	0.61	1.21	7	1.1	0.37	0.00
146	260	259	70	0.61	1.21	6	2.1	0.70	0.01
147	259	258	70	0.61	1.21	8	2.9	0.97	0.01
148	258	257	70	0.61	1.21	5	3.9	1.30	0.02
149	257	13/29	70	0.61	1.21	15	5.1	1.70	0.08
150	13/29	13/30	240	0.17	0.34	32	85.8	28.60	13.35
151	281	280	70	0.61	1.21	15	0.9	0.30	0.00
152	280	279	70	0.61	1.21	10	1.9	0.63	0.01
153	279	278	70	0.61	1.21	20	2.8	0.93	0.03
154	278	277	70	0.61	1.21	25	3.8	1.27	0.07
155	277	276	70	0.61	1.21	12	4.6	1.53	0.05
156	276	275	70	0.61	1.21	8	5.8	1.93	0.05

157	275	274	70	0 61	1 21	20	6 9	2.30	0.19
158	274	273	70	0 61	1 21	10	8	2.67	0.13
159	273	272	70	0 61	1 21	15	9	3 00	0 25
160	272	271	70	0 61	1 21	8	10	3 33	0 16
161	271	270	70	0 61	1 21	20	10 9	3 63	0 48
162	270	13/30/4	70	0 61	1 21	100	12.1	4 03	2.95
163	13/30/4	13/30/3	70	0 61	1 21	29	13 2	4 40	1 02
164	268	267	25	1 64	3 28	8	0.8	0 27	0 00
165	267	266	25	1 64	3.28	5	1 9	0 63	0 01
166	266	13/30/3	25	1 64	3.28	15	3 2	1 07	0 08
167	13/30/3	13/30/2	70	0 61	1 21	30	16 4	5 47	1 63
168	13/30/2	13/30/1	70	0 61	1 21	28	17 7	5.90	1 77
169	13/30/1	13/30	70	0 61	1 21	30	21.1	7 03	2.69
170	13/30	13/31	70	0 61	1 21	28	64 7	21 57	23.64
171	13/31	13/32	70	0 61	1 21	28	63.9	21.30	23 06
172	13/32	13/33	70	0 61	1 21	30	62.2	20 73	23.41
173	13/33	13/34	70	0.61	1 21	29	60.6	20.20	21.48
174	13/34	291	150	0 28	0 56	70	55.1	18.37	19.84
175	291	292	150	0 28	0.56	10	54.5	18.17	2.77
176	292	293	150	0.28	0 56	45	53.1	17.70	11 84
177	293	294	150	0.28	0.56	20	51.9	17.30	5.03
178	294	295	150	0.28	0 56	60	50.8	16 93	14 45
179	295	296	150	0.28	0.56	10	50	16 67	2.33
180	296	297	150	0.28	0.56	8	49.3	16 43	1 81
181	297	298	150	0 28	0 56	10	48 2	16.07	2.17
182	298	299	150	0 28	0 56	10	47.5	15 83	2.11
183	299	-	150	0.28	0 56	6	46.6	15.53	1.22
184	-	303	150	0 28	0 56	16	2	0 67	0 01
185	304	303	150	0.28	0.56	15	1	0 33	0 00
186	-	300	150	0 28	0.56	8	44.6	14 87	1 49
187	300	301	150	0 28	0 56	9	43.4	14 47	1 58
188	301	302	150	0.28	0.56	10	42.6	14 20	1 69
189	302	ACPB	150	0 28	0.56	15	41.8	13.93	2.45
190	348	347	70	0.61	1 21	7	0.9	0 30	0 00
191	347	346	70	0.61	1 21	15	2	0.67	0.01
192	346	345	70	0 61	1 21	10	3	1 00	0.02
193	345	344	70	0.61	1 21	16	3.6	1 20	0.04
194	344	342	70	0 61	1 21	15	5.5	1 83	0.09
195	342	341	70	0.61	1.21	10	5.6	1 87	0.06
196	341	340	70	0.61	1 21	15	7 7	2.57	0.18
197	340	339	70	0.61	1 21	10	8.9	2.97	0.16
198	339	338	70	0.61	1.21	10	9.7	3 23	0 19
199	338	337	70	0.61	1.21	15	10.7	3.57	0.35
200	337	ACPB	70	0 61	1 21	15	11.6	3 87	0.41
201	336	335	70	0.61	1 21	8	0.8	0 27	0.00
202	335	334	70	0.61	1.21	10	1 8	0.60	0.01
203	334	333	70	0.61	1 21	7	2.7	0.90	0.01
204	333	332	70	0.61	1 21	9	3.9	1.30	0.03
205	332	331	70	0.61	1.21	8	4.8	1 60	0.04
206	331	330	70	0.61	1 21	8	5.9	1.97	0.06
207	330	ACPB	70	0.61	1.21	10	6.7	2.23	0.09
208	332	321	150	0 28	0.56	10	0 7	0 23	0 00
209	321	320	150	0 28	0 56	9	1 7	0 57	0 00
210	320	319	150	0.28	0.56	8	2.9	0 97	0 01
211	319	318	150	0 28	0 56	7	3 9	1 30	0.01
212	318	317	150	0 28	0 56	8	4 7	1 57	0 02
213	317	316	150	0 28	0 56	11	5 6	1 87	0 03
214	316	315	150	0 28	0 56	10	6 7	2.23	0.04
215	315	-	150	0 28	0 56	10	7 5	2 50	0 05
216	329	328	150	0.28	0.56	10	1	0.33	0 00
217	328	327	150	0 28	0 56	7	1 80	0 60	0.00
218	327	326	150	0.28	0 56	8	3.1	1 03	0 01
219	326	325	150	0 28	0.56	9	3.9	1.30	0 01
220	325	324	150	0.28	0.56	8	4.7	1 57	0 02
221	324	323	150	0 28	0 56	10	5.9	1 97	0.03
222	323	-	150	0.28	0.56	10	7	2.33	0.05
223	-	314	150	0.28	0.56	10	14.5	4 83	0.20
224	314	313	150	0.28	0.56	8	15.4	5.13	0.18
225	313	312	150	0.28	0.56	15	16.3	5.43	0.37
226	312	311	150	0.28	0.56	15	17	5.67	0 41
227	311	310	150	0.28	0.56	10	18	6.00	0.30
228	310	309	150	0.28	0.56	7	18.9	6.30	0.23
229	309	308	150	0.28	0.56	10	19.7	6.57	0.36
230	308	307	150	0.28	0.56	8	20.5	6.83	0.31
231	307	306	150	0.28	0.56	10	21.6	7.20	0.44
232	306	305	150	0.28	0.56	10	22.4	7.47	0.47
233	305	ACPB	150	0.28	0.56	100	23.5	7 63	5.17
							Power loss in the main cable U6		1688.5

75	193	192	70	0 61	1 21	7	3.20	1 07	0 01
76	192	191	70	0 61	1 21	6	6 10	2 03	0 05
77	191	190	70	0 61	1 21	8	7 10	2 37	0 08
78	190	189	70	0 61	1.21	10	8.30	2.77	0 14
79	189	188	70	0.61	1 21	10	9.30	3.10	0 17
80	188	187	70	0 61	1 21	9	18.10	6 03	0.59
81	187	186	70	0 61	1 21	6	19.00	6 33	0 44
82	186	185	70	0.61	1 21	2	19.90	6 63	0.16
83	185	-	70	0 61	1.21	10	20.50	6 83	0 85
84	200	199	70	0.61	1.21	10	3.30	1 10	0 02
85	199	198	70	0 61	1.21	10	6 80	2.27	0 09
86	198	-	70	0.61	1.21	8	17.70	5 90	0.51
87	-	-	70	0 61	1 21	10	38.20	12 73	2.94
88	-	201	70	0 61	1 21	15	13.70	4 57	0 57
89	201	202	70	0 61	1 21	5	12.80	4 27	0 17
90	202	203	70	0.61	1 21	8	12.10	4 03	0 24
91	203	Mini PB	70	0 61	1.21	8	11.30	3 77	0.21
92	206	205	70	0.61	1 21	8	9.00	3.00	0.13
93	205	204	70	0 61	1 21	6	3 90	1 30	0 02
94	204	Mini PB	70	0.61	1.21	20	5 10	1.70	0 10
95	212	215	70	0 61	1 21	7	1 00	0.33	0.00
96	215	214	70	0 61	1 21	8	1.90	0 63	0 01
97	214	211	70	0.61	1 21	6	2.60	0 87	0.01
98	211	213	70	0 61	1.21	8	3 60	1.20	0 02
99	213	210	70	0 61	1 21	5	4.50	1 50	0 02
100	210	Mini PB	70	0.61	1 21	15	5.50	1 83	0 09
101	13/21	13/22	240	0.17	0 34	32	128 70	42.90	30 04
102	233	232	70	0 61	1 21	8	0 90	0.30	0 00
103	232	231	70	0 61	1 21	6	2 10	0 70	0 01
104	231	230	70	0 61	1 21	6	3.20	1.07	0 01
105	230	229	70	0 61	1 21	8	4 40	1.47	0.03
106	229	228	70	0 61	1 21	10	5.50	1.83	0 06
107	228	227	70	0 61	1.21	6	6.20	2.07	0.05
108	227	226	70	0 61	1 21	5	7 30	2.43	0.05
109	226	225	70	0 61	1 21	8	8.30	2.77	0.11
110	225	-	70	0 61	1 21	25	9.10	3 03	0 42
111	216	217	25	1.64	3 28	10	1 0	0.33	0.01
112	217	-	25	1 64	3 28	10	1 60	0.53	0 01
113	-	-	70	0.61	1 21	5	15.3	5.10	0 24
114	-	218	70	0 61	1 21	10	6 2	2.07	0 08
115	218	219	70	0 61	1 21	8	5.5	1.83	0 05
116	219	220	70	0 61	1.21	6	4 4	1 47	0.02
117	220	221	70	0 61	1 21	6	3.6	1.20	0.02
118	221	222	70	0 61	1 21	8	2.8	0.93	0 01
119	222	223	70	0 61	1 21	10	1.9	0.63	0 01
120	223	224	70	0 61	1 21	8	1	0 33	0 00
121	13/22	13/23	70	0 61	1 21	30	113 4	37.80	77.80
122	13/23	13/24	70	0.61	1 21	30	111 5	37 17	75.22
123	244	243	70	0 61	1 21	9	1	0.33	0 00
124	243	242	70	0 61	1 21	6	2	0 67	0 00
125	242	241	70	0 61	1 21	8	2.9	0 97	0.01
126	241	240	70	0 61	1 21	8	3 7	1 23	0.02
127	240	-	70	0 61	1 21	10	4 7	1 57	0 04
128	-	238	25	1 64	3 28	10	1 8	0 60	0 02
129	238	239	25	1 64	3 28	10	0 8	0 27	0 00
130	-	-	70	0 61	1 21	15	6 5	2 17	0.13
131	-	245	70	0 61	1.21	10	9 2	3 07	0.17
132	-	13/24	70	0 61	1 21	20	15 7	5.23	0.99
133	245	246	70	0 61	1 21	20	8 2	2 73	0.27
134	246	-	70	0 61	1 21	5	7 3	2 43	0.05
135	-	247	70	0 61	1 21	5	3 6	1.20	0 01
136	247	248	70	0 61	1 21	8	2 7	0 90	0 01
137	248	249	70	0 61	1 21	10	1 5	0 50	0.00
138	249	250	70	0 61	1 21	11	0 7	0 23	0 00
139	-	251	70	0 61	1 21	8	3 7	1.23	0 02
140	251	252	70	0 61	1 21	6	3 1	1 03	0 01
141	252	253	70	0 61	1 21	8	2 4	0.80	0 01
142	253	254	70	0 61	1 21	9	1 4	0 47	0 00
143	254	255	70	0 61	1 21	8	0 7	0.23	0 00
144	13/24	13/29	70	0 61	1 21	320	94 3	31 43	573.86
145	261	260	70	0 61	1 21	7	1 1	0.37	0 00
146	260	259	70	0 61	1 21	6	2 1	0 70	0 01
147	259	258	70	0.61	1 21	8	2 9	0.97	0.01
148	258	257	70	0 61	1 21	5	3.9	1.30	0 02
149	257	13/29	70	0 61	1 21	15	5.1	1 70	0.08
150	13/29	13/30	240	0 17	0 34	32	85 8	28.60	13.35
151	281	280	70	0.61	1 21	15	0.9	0 30	0.00
152	280	279	70	0 61	1.21	10	1.9	0.63	0.01
153	279	278	70	0 61	1 21	20	2.8	0.93	0.03
154	278	277	70	0.61	1.21	25	3.8	1.27	0.07
155	277	276	70	0.61	1 21	12	4.6	1.53	0.05
156	276	275	70	0.61	1.21	8	5.8	1.93	0.05

157	275	274	70	0.61	1.21	20	6.9	2.30	0.19
158	274	273	70	0.61	1.21	10	8	2.67	0.13
159	273	272	70	0.61	1.21	15	9	3.00	0.25
160	272	271	70	0.61	1.21	8	10	3.33	0.16
161	271	270	70	0.61	1.21	20	10.9	3.63	0.48
162	270	13/30/4	70	0.61	1.21	100	12.1	4.03	2.95
163	13/30/4	13/30/3	70	0.61	1.21	29	13.2	4.40	1.02
164	268	267	25	1.64	3.28	8	0.8	0.27	0.00
165	267	266	25	1.64	3.28	5	1.9	0.63	0.01
166	266	13/30/3	25	1.64	3.28	15	3.2	1.07	0.08
167	13/30/3	13/30/2	70	0.61	1.21	30	16.4	5.47	1.63
168	13/30/2	13/30/1	70	0.61	1.21	28	17.7	5.90	1.77
169	13/30/1	13/30	70	0.61	1.21	30	21.1	7.03	2.69
170	13/30	13/31	70	0.61	1.21	28	64.7	21.57	23.64
171	13/31	13/32	70	0.61	1.21	28	63.9	21.30	23.06
172	13/32	13/33	70	0.61	1.21	30	62.2	20.73	23.41
173	13/33	13/34	70	0.61	1.21	29	60.6	20.20	21.48
174	13/34	291	150	0.28	0.56	70	55.1	18.37	19.84
175	291	292	150	0.28	0.56	10	54.5	18.17	2.77
176	292	293	150	0.28	0.56	45	53.1	17.70	11.84
177	293	294	150	0.28	0.56	20	51.9	17.30	5.03
178	294	295	150	0.28	0.56	60	50.8	16.93	14.45
179	295	296	150	0.28	0.56	10	50	16.67	2.33
180	296	297	150	0.28	0.56	8	49.3	16.43	1.81
181	297	298	150	0.28	0.56	10	48.2	16.07	2.17
182	298	299	150	0.28	0.56	10	47.5	15.83	2.11
183	299	-	150	0.28	0.56	6	46.6	15.53	1.22
184	-	303	150	0.28	0.56	16	2	0.67	0.01
185	304	303	150	0.28	0.56	15	1	0.33	0.00
186	-	300	150	0.28	0.56	8	44.6	14.87	1.49
187	300	301	150	0.28	0.56	9	43.4	14.47	1.58
188	301	302	150	0.28	0.56	10	42.6	14.20	1.69
189	302	ACPB	150	0.28	0.56	15	41.8	13.93	2.45
190	348	347	70	0.61	1.21	7	0.9	0.30	0.00
191	347	346	70	0.61	1.21	15	2	0.67	0.01
192	346	345	70	0.61	1.21	10	3	1.00	0.02
193	345	344	70	0.61	1.21	16	3.6	1.20	0.04
194	344	342	70	0.61	1.21	15	5.5	1.83	0.09
195	342	341	70	0.61	1.21	10	5.6	1.87	0.06
196	341	340	70	0.61	1.21	15	7.7	2.57	0.18
197	340	339	70	0.61	1.21	10	8.9	2.97	0.16
198	339	338	70	0.61	1.21	10	9.7	3.23	0.19
199	338	337	70	0.61	1.21	15	10.7	3.57	0.35
200	337	ACPB	70	0.61	1.21	15	11.6	3.87	0.41
201	336	335	70	0.61	1.21	8	0.8	0.27	0.00
202	335	334	70	0.61	1.21	10	1.8	0.60	0.01
203	334	333	70	0.61	1.21	7	2.7	0.90	0.01
204	333	332	70	0.61	1.21	9	3.9	1.30	0.03
205	332	331	70	0.61	1.21	8	4.8	1.60	0.04
206	331	330	70	0.61	1.21	8	5.9	1.97	0.06
207	330	ACPB	70	0.61	1.21	10	6.7	2.23	0.09
208	332	321	150	0.28	0.56	10	0.7	0.23	0.00
209	321	320	150	0.28	0.56	9	1.7	0.57	0.00
210	320	319	150	0.28	0.56	8	2.9	0.97	0.01
211	319	318	150	0.28	0.56	7	3.9	1.30	0.01
212	318	317	150	0.28	0.56	8	4.7	1.57	0.02
213	317	316	150	0.28	0.56	11	5.6	1.87	0.03
214	316	315	150	0.28	0.56	10	6.7	2.23	0.04
215	315	-	150	0.28	0.56	10	7.5	2.50	0.05
216	329	328	150	0.28	0.56	10	1	0.33	0.00
217	328	327	150	0.28	0.56	7	1.80	0.60	0.00
218	327	326	150	0.28	0.56	8	3.1	1.03	0.01
219	326	325	150	0.28	0.56	9	3.9	1.30	0.01
220	325	324	150	0.28	0.56	8	4.7	1.57	0.02
221	324	323	150	0.28	0.56	10	5.9	1.97	0.03
222	323	-	150	0.28	0.56	10	7	2.33	0.05
223	-	314	150	0.28	0.56	10	14.5	4.83	0.20
224	314	313	150	0.28	0.56	8	15.4	5.13	0.18
225	313	312	150	0.28	0.56	15	16.3	5.43	0.37
226	312	311	150	0.28	0.56	15	17	5.67	0.41
227	311	310	150	0.28	0.56	10	18	6.00	0.30
228	310	309	150	0.28	0.56	7	18.9	6.30	0.23
229	309	308	150	0.28	0.56	10	19.7	6.57	0.36
230	308	307	150	0.28	0.56	8	20.5	6.83	0.31
231	307	306	150	0.28	0.56	10	21.6	7.20	0.44
232	306	305	150	0.28	0.56	10	22.4	7.47	0.47
233	305	ACPB	150	0.28	0.56	100	23.5	7.83	5.17
								Power loss in the main cable U6	1688.5

Akra Colony O/T

Calculation of LT Distribution Loss

SVC .NO	TYPE	PHASE	SIZE (MM2)	Resistance (ohm/KM) Phase	Resistance (ohm/KM) Neutral	LENGTH (m)	Current Readings (A)				Power Loss (Watts)
							I(R)	I(B)	[redacted]	I(N)	
					"DATA OF UNIT 4"						
1	UG	1	25	1.64	3.28	10	0.8			0.8	0.031
2	UG	3	25	1.64	3.28	8	1.2	1.2	1.2		0.057
3	UG	1	25	1.64	3.28	12	0.9			0.9	0.048
4	UG	1	25	1.64	3.28	7	0.9			0.9	0.028
5	UG	3	25	1.64	3.28	11	1	1.1	1		0.058
6	UG	1	25	1.64	3.28	8			0.9	0.9	0.032
7	UG	1	25	1.64	3.28	10	0.9			0.9	0.040
8	UG	1	25	1.64	3.28	9		1		1.0	0.044
9	UG	3	25	1.64	3.28	10	0.9	0.9	0.9		0.040
10	UG	1	25	1.64	3.28	11			1.2	1.2	0.078
11	UG	1	25	1.64	3.28	12	0.9			0.9	0.048
12	UG	1	25	1.64	3.28	8		0.9		0.9	0.032
13	UG	1	25	1.64	3.28	9			0.8	0.8	0.028
14	UG	1	25	1.64	3.28	8	0.7			0.7	0.019
15	UG	1	25	1.64	3.28	12		0.9		0.9	0.048
16	UG	3	25	1.64	3.28	10	1.1	1.1	1.1	0.0	0.060
17	UG	1	25	1.64	3.28	11	1.1			1.1	0.065
18	UG	1	25	1.64	3.28	12	0.8			0.8	0.038
19	UG	3	25	1.64	3.28	8			0.9	0.9	0.032
20	UG	1	25	1.64	3.28	9	0.9	0.9	1		0.039
21	OH	1	25	1.64	3.28	11	0.8			0.8	0.035
											0.899
					"DATA OF UNIT 5"						
22	OH	1	10	4.02	8.03	23	0.9			0.9	0.224
23	OH	1	10	4.02	8.03	21		0.9		0.9	0.205
24	OH	1	10	4.02	8.03	20			1	1.0	0.241
25	OH	1	10	4.02	8.03	21	0.8			0.8	0.162
26	OH	1	10	4.02	8.03	20		0.8		0.8	0.154
27	OH	1	10	4.02	8.03	25			0.9	0.9	0.244
28	OH	1	10	4.02	8.03	21	1			1.0	0.253
29	OH	1	10	4.02	8.03	18		0.8		0.8	0.139
30	OH	1	10	4.02	8.03	23			0.8	0.8	0.177
31	OH	1	10	4.02	8.03	21	0.9			0.9	0.205
32	OH	1	10	4.02	8.03	24		1.2		1.2	0.416
33	OH	1	10	4.02	8.03	22			0.7	0.7	0.130
34	OH	1	10	4.02	8.03	23	0.9			0.9	0.224
35	OH	1	10	4.02	8.03	22			0.8	0.8	0.170
36	OH	1	10	4.02	8.03	17		0.8		0.8	0.131
37	OH	1	10	4.02	8.03	13	0.7			0.7	0.077
38	OH	1	10	4.02	8.03	15			1	1.0	0.181
39	OH	1	10	4.02	8.03	18		0.9		0.9	0.176
40	OH	1	10	4.02	8.03	15	0.9			0.9	0.146
41	OH	1	10	4.02	8.03	18			0.8	0.8	0.139
42	OH	1	10	4.02	8.03	22		1		1.0	0.265
43	OH	1	10	4.02	8.03	14	1			1.0	0.169
44	OH	1	10	4.02	8.03	19			0.9	0.9	0.185
45	OH	1	10	4.02	8.03	23		1		1.0	0.277
46	OH	1	10	4.02	8.03	14			1.1	1.1	0.204
47	OH	1	10	4.02	8.03	18	0.9			0.9	0.176
48	OH	1	10	4.02	8.03	12		1.1		1.1	0.175
49	OH	1	10	4.02	8.03	10			0.9	0.9	0.098
50	OH	1	10	4.02	8.03	14	1			1.0	0.169
51	OH	1	10	4.02	8.03	11		0.9		0.9	0.107
52	OH	1	10	4.02	8.03	15			1.1	1.1	0.219
53	OH	1	10	4.02	8.03	14	1			1.0	0.169
54	OH	1	10	4.02	8.03	13		0.9		0.9	0.127
55	OH	1	10	4.02	8.03	16			1.1	1.1	0.233
56	OH	1	10	4.02	8.03	18	1.1			1.1	0.262
57	OH	3	18	2.53	5.05	18	0.9	0.9	0.9	0.0	0.111
58	OH	3	18	2.53	5.05	14	1.1	1.1	1		0.121
											0.183

60	OH	1	10	4.02	8.03	12			0.9	0.9	0.117
61	OH	1	10	4.02	8.03	12		0.9		0.9	0.117
62	OH	3	18	2.53	5.05	14	1	1	1	0.0	0.106
63	OH	1	10	4.02	8.03	45	0.7			0.7	0.266
64	OH	1	10	4 02	8.03	17	1.1			1.1	0.248
65	OH	1	10	4.02	8.03	12		0.9		0.9	0.117
66	OH	3	18	2.53	5 05	10	0.9	1	1		0.071
67	OH	1	10	4.02	8.03	11			0.9	0.9	0.107
68	OH	1	10	4.02	8.03	14	0.9			0.9	0.137
69	OH	3	18	2.53	5.05	12	1.2	1.1	1.1		0.117
70	OH	1	10	4.02	8.03	22		0.8		0.8	0.170
71	OH	1	10	4 02	8.03	14			0.8	0.8	0.108
72	OH	1	10	4.02	8.03	15	1			1.0	0.181
73	OH	1	10	4.02	8.03	13		1		1.0	0.157
74	OH	1	10	4.02	8.03	18	1.1			1.1	0.262
75	OH	1	10	4.02	8.03	21			0.7	0.7	0.124
76	OH	1	10	4.02	8.03	20	1.2			1.2	0.347
77	OH	1	10	4.02	8 03	14		1.1		1.1	0.204
77a	OH	1	10	4.02	8.03	21	1.2			1.2	0.364
78	OH	3	10	4.02	8.03	14			1.2	1.2	0.243
78a	OH	1	10	4.02	8.03	21		0.9		0.9	0.205
78b	OH	3	18	2.53	5.05	21	1.2	1.2	1.2	0.0	0.230
78c	OH	1	10	4 02	8.03	14	0.9			0.9	0.137
78d	OH	1	10	4.02	8.03	18			1.3	1.3	0.367
78e	OH	1	10	4.02	8.03	14			1	1.0	0.169
79	OH	3	10	4.02	8.03	15	0.8	0.8	0.8	0.0	0.116
79a	OH	1	10	4.02	8.03	13		0.8		0.8	0.100
80	OH	1	10	4.02	8.03	11	0.9			0.9	0.107
81	OH	1	10	4.02	8.03	14		0.7		0.7	0.083
82	UG	1	25	1.64	3.28	8			0.9	0.9	0.032
83	UG	1	25	1.64	3.28	9	0.7			0.7	0.022
84	UG	1	25	1.64	3.28	11			1.2	1.2	0.078
85	UG	1	25	1.64	3.28	8		0.8		0.8	0.025
86	UG	1	25	1.64	3.28	8	0.9			0.9	0.032
87	UG	1	25	1.64	3.28	10			0.9	0.9	0.040
88	UG	1	25	1.64	3.28	9			0.7	0.7	0.022
89	OH	1	10	4.02	8.03	15	0.9			0.9	0.146
90	OH	1	10	4.02	8.03	12		1		1.0	0.145
91	OH	1	10	4.02	8.03	12			1	1.0	0.145
92	OH	1	10	4.02	8.03	18	0.9			0.9	0.176
93	OH	3	18	2.53	5.05	18	0.9	1.1	1.1		0.147
94	OH	3	18	2.53	5.05	10	1	0.9	0.9		0.066
95	OH	1	10	4.02	8.03	8		1.2		1.2	0.139
96	OH	1	10	4.02	8.03	12			1.1	1.1	0.175
97	OH	1	10	4.02	8.03	7	1			1.0	0.084
98	OH	1	10	4.02	8.03	11		1.1		1.1	0.160
99	OH	1	10	4.02	8.03	8			0.9	0.9	0.078
100	OH	1	10	4.02	8.03	10	1.1			1.1	0.146
101	OH	1	10	4.02	8.03	9		0.9		0.9	0.088
101a	OH	1	10	4.02	8.03	10			0.8	0.8	0.077
102	UG	1	25	1.64	3.28	11	1			1.0	0.054
103	UG	1	25	1.64	3.28	12		1		1.0	0.059
104	UG	1	25	1.64	3.28	8			0.7	0.7	0.019
105	UG	1	25	1.64	3.28	9	0.9			0.9	0.036
106	UG	1	25	1.64	3.28	8			1	1.0	0.039
107	UG	1	25	1.64	3.28	12		0.9		0.9	0.048
108	UG	1	25	1.64	3.28	10			0.9	0.9	0.040
109	UG	1	25	1.64	3.28	11	0.8			0.8	0.035
110	OH	1	10	4.02	8.03	23			0.8	0.8	0.177
110a	OH	1	10	4.02	8.03	21		1		1.0	0.253
110b	OH	1	10	4.02	8.03	20	0.9			0.9	0.195
110c	OH	1	10	4.02	8.03	21		0.8		0.8	0.162
110d	OH	1	10	4.02	8.03	20					0.000
111	OH	1	10	4.02	8.03	25	1			1.0	0.301
112	OH	1	10	4.02	8.03	21		0.8		0.8	0.162
113	OH	1	10	4.02	8.03	10			1	1.0	0.121
114	OH	1	10	4.02	8.03	23	1.1			1.1	0.335
115	OH	1	10	4.02	8.03	21		0.9		0.9	0.205
		1	10	4.02	8.03	24		0.8		0.8	0.185
						22	0.8			0.8	0.170

118	OH	1	10	4.02	8.03	23			1.1	1.1	0.335
119	OH	1	10	4.02	8.03	22		0.9		0.9	0.215
120	OH	1	10	4.02	8.03	17	0.8			0.8	0.131
121	OH	1	10	4.02	8.03	18			0.8	0.8	0.139
122	OH	1	10	4.02	8.03	18		1		1.0	0.217
123	OH	1	10	4.02	8.03	18	0.7			0.7	0.106
124	OH	1	10	4.02	8.03	15			0.9	0.9	0.146
124a	OH	1	10	4.02	8.03	18		0.8		0.8	0.139
125	OH	1	10	4.02	8.03	22			1	1.0	0.265
126	OH	1	10	4.02	8.03	14	0.7			0.7	0.083
127	OH	1	10	4.02	8.03	19		1.1		1.1	0.277
128	OH	1	10	4.02	8.03	23			0.9	0.9	0.224
129	OH	1	10	4.02	8.03	14	0.6			0.6	0.061
130	OH	1	10	4.02	8.03	18		1		1.0	0.217
131	OH	1	10	4.02	8.03	12			1	1.0	0.145
132	OH	1	10	4.02	8.03	10		0.9		0.9	0.098
132a	OH	1	10	4.02	8.03	14	0.7			0.7	0.083
133	OH	1	10	4.02	8.03	21		1.1		1.1	0.306
134	OH	1	10	4.02	8.03	23			1.1	1.1	0.335
135	OH	1	10	4.02	8.03	15		1.2		1.2	0.260
136	OH	1	10	4.02	8.03	14	0.8			0.8	0.108
137	OH	1	10	4.02	8.03	10		0.8		0.8	0.077
138	OH	1	10	4.02	8.03	8	0.8			0.8	0.062
139	OH	1	10	4.02	8.03	12		0.8		0.8	0.093
140	OH	1	10	4.02	8.03	7	1			1.0	0.084
141	OH	1	10	4.02	8.03	11		0.9		0.9	0.107
141a	OH	1	10	4.02	8.03	8			0.6	0.6	0.035
											21
"DATA OF UNIT 6"											
142	OH	1	10	4.02	8.03	10	0.9			0.9	0.098
143	OH	1	10	4.02	8.03	9		0.9		0.9	0.088
144	OH	1	10	4.02	8.03	10	0.9			0.9	0.098
145	OH	1	10	4.02	8.03	11			0.9	0.9	0.107
146	OH	1	10	4.02	8.03	12	1			1.0	0.145
147	OH	1	10	4.02	8.03	8		1		1.0	0.096
148	UG	1	25	1.64	3.28	9			1	1.0	0.044
149	UG	1	25	1.64	3.28	8	1.1			1.1	0.048
150	UG	1	25	1.64	3.28	12		1.1		1.1	0.071
151	UG	1	25	1.64	3.28	10			1.1	1.1	0.060
152	UG	1	25	1.64	3.28	11	0.9			0.9	0.044
153	UG	3	25	1.64	3.28	12	1.2	1.2	1.2	0.0	0.085
154	UG	1	25	1.64	3.28	8		1.2		1.2	0.057
155	UG	1	25	1.64	3.28	9			1.1	1.1	0.054
156	UG	3	25	1.64	3.28	11	0.7	0.9	0.9		0.038
157	UG	1	25	1.64	3.28	11			0.6	0.6	0.019
158	UG	1	25	1.64	3.28	10	1			1.0	0.049
159	UG	3	25	1.64	3.28	14	0.8	0.8	0.9		0.048
160	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
161	UG	1	25	1.64	3.28	9		0.8		0.8	0.028
162	UG	1	25	1.64	3.28	8	0.9			0.9	0.032
163	UG	1	25	1.64	3.28	10			0.7	0.7	0.024
164	UG	1	25	1.64	3.28	8	0.8			0.8	0.025
165	UG	1	25	1.64	3.28	7		0.7		0.7	0.017
166	UG	1	25	1.64	3.28	10			0.7	0.7	0.024
167	UG	3	25	1.64	3.28	12	0.9	0.9	0.9	0.0	0.048
168	UG	1	25	1.64	3.28	11	0.9			0.9	0.044
169	UG	1	25	1.64	3.28	7		0.6		0.6	0.012
170	UG	1	25	1.64	3.28	8			0.6	0.6	0.014
171	UG	1	25	1.64	3.28	11	1			1.0	0.054
172	UG	1	25	1.64	3.28	11		1.2		1.2	0.078
173	UG	1	25	1.64	3.28	10	1.1			1.1	0.060
174	UG	1	25	1.64	3.28	14			1.2	1.2	0.099
175	UG	1	25	1.64	3.28	8		1.1		1.1	0.048
176	UG	1	25	1.64	3.28	8	1.2			1.2	0.057
177	UG	1	25	1.64	3.28	8			1	1.0	0.039
178	UG	3	25	1.64	3.28	10	1	1	1	0.0	0.049
179	UG	1	25	1.64	3.28	8			1	1.0	0.039
180	UG	1	25	1.64	3.28	7	0.8			0.8	0.022
181	UG	1	25	1.64	3.28	10		0.9		0.9	0.040
182	OH	1	10	4.02	8.03	12			0.8	0.8	0.093

183	OH	1	10	4 02	8.03	11	0.9			0.9	0.107
184	OH	1	10	4 02	8.03	15		0.8		0.8	0.116
185	UG	1	25	1 64	3.28	8			0.6	0.6	0.014
186	UG	1	25	1.64	3.28	8	0.9			0.9	0.032
187	UG	1	25	1.64	3.28	11		0.9		0.9	0.044
188	UG	1	25	1 64	3.28	12			0.9	0.9	0.048
189	UG	1	25	1 64	3.28	10	1			1.0	0.049
190	UG	1	25	1.64	3.28	10		1.2		1.2	0.071
191	UG	1	25	1 64	3.28	8			1	1.0	0.039
192	UG	1	25	1.64	3.28	12	0.9			0.9	0.048
193	UG	1	20	1.64	3.28	7	0.6			0.6	0.012
194	UG	1	25	1.64	3.28	11		1.3		1.3	0.091
195	UG	1	25	1.64	3.28	8	1.1			1.1	0.048
196	UG	1	25	1.64	3.28	10			1.1	1.1	0.060
197	UG	1	25	1.64	3.28	9		1.1		1.1	0.054
198	UG	1	25	1.64	3.28	10	0.9			0.9	0.040
199	UG	3	25	1.64	3.28	11	1.1	1.2	1.2		0.074
200	UG	3	25	1.64	3.28	12	1.1	1.1	1.1	0.0	0.071
201	UG	1	20	1.64	3.28	8			0.9	0.9	0.032
202	UG	1	25	1.64	3.28	8	0.7			0.7	0.019
203	UG	1	25	1.64	3.28	8		0.8		0.8	0.025
204	UG	1	25	1.64	3.28	12			1.2	1.2	0.085
205	UG	3	25	1 64	3.28	10	1	1	1	1.0	0.082
206	UG	1	25	1.64	3.28	11			0.9	0.9	0.044
207	UG	1	25	1.64	3.28	12	1.1			1.1	0.071
208	UG	1	25	1 64	3.28	8		0.9		0.9	0.032
209	UG	1	25	1.64	3.28	9			1.1	1.1	0.054
210	UG	1	25	1.64	3.28	11	1			1.0	0.054
211	UG	1	25	1.64	3.28	10		1		1.0	0.049
212	UG	1	25	1.64	3.28	14	1			1.0	0.069
213	UG	1	25	1.64	3.28	11		0.9		0.9	0.044
214	UG	1	25	1.64	3.28	9			0.7	0.7	0.022
215	UG	1	25	1.64	3.28	14	0.9			0.9	0.056
216	UG	1	25	1.64	3.28	8		1		1.0	0.039
217	UG	1	25	1.64	3.28	7			0.6	0.6	0.012
218	UG	1	25	1.64	3.28	10	0.7			0.7	0.024
219	UG	1	25	1.64	3.28	9		1.1		1.1	0.054
220	UG	1	25	1.64	3.28	7			0.8	0.8	0.022
221	UG	1	25	1.64	3.28	11	0.8			0.8	0.035
222	UG	1	25	1.64	3.28	10		0.9		0.9	0.040
223	UG	1	25	1.64	3.28	11			0.9	0.9	0.044
224	UG	1	25	1.64	3.28	11	1			1.0	0.054
225	UG	1	25	1 64	3.28	11		0.8		0.8	0.035
226	UG	1	25	1.64	3.28	8			1	1.0	0.039
227	UG	1	25	1.64	3.28	10	1.1			1.1	0.060
228	UG	1	25	1.64	3.28	8		0.7		0.7	0.019
229	UG	1	25	1.64	3.28	10			1.1	1.1	0.060
230	UG	1	25	1.64	3.28	11	1.2			1.2	0.078
231	UG	1	25	1.64	3.28	12			1.1	1.1	0.071
232	UG	1	25	1.64	3.28	8		1.2		1.2	0.057
233	UG	1	25	1.64	3.28	9	0.9			0.9	0.036
234	OH	1	10	4.02	8.03	11			0.9	0.9	0.107
235	OH	1	10	4.02	8.03	12		1		1.0	0.145
236	OH	1	10	4.02	8.03	10	0.7			0.7	0.059
237	OH	1	10	4.02	8.03	18			0.8	0.8	0.139
238	UG	1	25	1.64	3.28	12		1		1.0	0.059
239	UG	1	25	1.64	3.28	8	0.8			0.8	0.025
240	UG	1	25	1.64	3.28	10			1	1.0	0.049
241	UG	1	25	1.64	3.28	8		0.8		0.8	0.025
242	UG	1	25	1.64	3.28	12	0.9			0.9	0.048
243	UG	1	25	1.64	3.28	7			1	1.0	0.034
244	UG	1	25	1.64	3.28	11		1		1.0	0.054
245	UG	1	25	1.64	3.28	8	1			1.0	0.039
246	UG	1	25	1.64	3.28	10			0.9	0.9	0.040
247	UG	1	25	1.64	3.28	9		0.9		0.9	0.036
248	UG	1	25	1.64	3.28	10	1.2			1.2	0.071
249	UG	1	25	1.64	3.28	11			0.8	0.8	0.035
250	UG	1	25	1.64	3.28	12			0.7	0.7	0.029
251	UG	1	25	1.64	3.28	8	0.6			0.6	0.014
252	UG	1	25	1.64	3.28	8		0.7		0.7	0.019

253	UG	1	25	1.64	3.28	8			1	1.0	0.039
254	UG	1	25	1.64	3.28	12	0.7			0.7	0.029
255	UG	1	25	1.64	3.28	10		0.7		0.7	0.024
256	OH	3	16	2.53	5.05	10	1.1	1.2	1.1		0.098
257	UG	1	25	1.64	3.28	12			1.2	1.2	0.085
258	UG	1	25	1.64	3.28	8	1			1.0	0.039
259	UG	1	25	1.64	3.28	9		0.8		0.8	0.028
260	UG	1	25	1.64	3.28	11			1	1.0	0.054
261	UG	1	25	1.64	3.28	8	1.1			1.1	0.048
262	OH	1	10	4.02	8.03	21		1		1.0	0.253
263	OH	1	10	4.02	8.03	20	1.2			1.2	0.347
264	OH	1	10	4.02	8.03	21			1.2	1.2	0.364
265	OH	1	10	4.02	8.03	20			1.3	1.3	0.407
266	UG	1	25	1.64	3.28	25	1.3			1.3	0.208
267	UG	1	25	1.64	3.28	21		1.1		1.1	0.125
268	UG	1	25	1.64	3.28	9			0.8	0.8	0.028
269	OH	1	10	4.02	8.03	23	1.1			1.1	0.335
270	UG	1	10	4.02	8.03	11		1.2		1.2	0.191
271	UG	1	10	4.02	8.03	9			0.9	0.9	0.088
272	UG	1	10	4.02	8.03	7			1	1.0	0.084
273	UG	1	10	4.02	8.03	12	1			1.0	0.145
274	UG	1	10	4.02	8.03	13		1.1		1.1	0.190
275	UG	1	25	1.64	3.28	9			1.1	1.1	0.054
276	UG	1	25	1.64	3.28	8	1.2			1.2	0.057
277	UG	1	25	1.64	3.28	10		0.8		0.8	0.031
278	UG	1	25	1.64	3.28	11			1	1.0	0.054
279	UG	1	25	1.64	3.28	8	0.9			0.9	0.032
280	UG	1	25	1.64	3.28	7			1	1.0	0.034
281	UG	1	25	1.64	3.28	11		0.9		0.9	0.044
282	OH	1	10	4.02	8.03	13	0.8			0.8	0.100
283	OH	1	10	4.02	8.03	15			0.9	0.9	0.146
284	OH	1	10	4.02	8.03	14	0.8			0.8	0.108
285	OH	1	10	4.02	8.03	10		0.8		0.8	0.077
286	OH	1	10	4.02	8.03	18			0.8	0.8	0.139
287	OH	1	10	4.02	8.03	18	1			1.0	0.217
288	OH	1	10	4.02	8.03	12			0.8	0.8	0.093
289	OH	3	16	2.53	5.05	13	0.9	0.9	0.9	0.0	0.080
290	OH	1	10	4.02	8.03	10		1		1.0	0.121
291	UG	1	25	1.64	3.28	8	1			1.0	0.039
292	UG	1	25	1.64	3.28	12			1	1.0	0.059
293	UG	1	25	1.64	3.28	7		1.2		1.2	0.050
294	UG	1	25	1.64	3.28	1	1.1			1.1	0.006
295	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
296	UG	1	25	1.64	3.28	10		0.7		0.7	0.024
297	UG	1	25	1.64	3.28	9	1.1			1.1	0.054
298	UG	1	25	1.64	3.28	10			0.7	0.7	0.024
299	UG	1	25	1.64	3.28	11		0.9		0.9	0.044
300	UG	1	25	1.64	3.28	12	1.2			1.2	0.085
301	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
302	UG	1	25	1.64	3.28	9		0.8		0.8	0.028
303	UG	1	25	1.64	3.28	8	1			1.0	0.039
304	UG	1	25	1.64	3.28	12			1	1.0	0.059
305	UG	1	25	1.64	3.28	10		1.1		1.1	0.060
306	UG	1	25	1.64	3.28	11	0.8			0.8	0.035
307	UG	1	25	1.64	3.28	12			1.1	1.1	0.071
308	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
309	UG	1	25	1.64	3.28	9	0.8			0.8	0.028
310	UG	1	25	1.64	3.28	11		0.9		0.9	0.044
311	UG	1	25	1.64	3.28	10			1	1.0	0.049
312	UG	1	25	1.64	3.28	14	0.7			0.7	0.034
313	UG	1	25	1.64	3.28	11			0.9	0.9	0.044
314	UG	1	25	1.64	3.28	9		0.9		0.9	0.036
315	UG	1	25	1.64	3.28	14	0.8			0.8	0.044
316	UG	1	25	1.64	3.28	8		1.1		1.1	0.048
317	UG	1	25	1.64	3.28	7	0.9			0.9	0.028
318	UG	1	25	1.64	3.28	10			0.8	0.8	0.031
319	UG	1	25	1.64	3.28	9	1			1.0	0.044
320	UG	1	25	1.64	3.28	7		1.2		1.2	0.050
321	UG	1	25	1.64	3.28	11	1.1			1.1	0.065
322	UG	1	25	1.64	3.28	10			0.7	0.7	0.024

323	UG	1	25	1 64	3.28	11		1.1		1 1	0.065
324	UG	1	25	1 64	3.28	11	1.2			1.2	0.078
325	UG	1	25	1.64	3.28	11			0.8	0.8	0.035
326	UG	1	25	1 64	3 28	8		0.8		0.8	0.025
327	UG	1	25	1.64	3.28	10	1.3			1.3	0.083
328	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
329	UG	1	25	1.64	3.28	10			1	1 0	0.049
330	UG	1	25	1.64	3.28	11	0.8			0.8	0.035
331	UG	1	25	1.64	3.28	12			1.1	1.1	0.071
332	UG	1	25	1.64	3.28	8		0.9		0.9	0.032
333	UG	1	25	1 64	3.28	8			1.2	1.2	0.057
334	UG	1	25	1.64	3.28	11			0.9	0.9	0.044
335	UG	1	25	1.64	3.28	12	1			1.0	0.059
336	UG	1	25	1 64	3.28	10			0.8	0.8	0.031
337	UG	1	25	1.64	3.28	18		0.9		0.9	0.072
338	UG	1	25	1.64	3.28	12			1	1.0	0.059
339	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
340	UG	1	25	1.64	3.28	12		1.2		1.2	0.085
341	UG	1	25	1.64	3.28	8	1.1			1.1	0.048
342	UG	1	25	1.64	3.28	9		1.1		1.1	0.054
343	UG	1	25	1.64	3.28	11			0.9	0.9	0.044
344	UG	1	25	1.64	3.28	10		1		1.0	0.049
345	UG	1	25	1.64	3.28	14			0.6	0.6	0.025
346	UG	1	25	1.64	3.28	11		1		1.0	0.054
347	UG	1	25	1.64	3.28	9	1.1			1.1	0.054
348	UG	1	25	1.64	3.28	14		0.9		0.9	0.056
349	UG	1	25	1.64	3.28	8			0.7	0.7	0.019
350	UG	1	25	1.64	3.28	7			0.8	0.8	0.022
351	UG	1	25	1.64	3.28	10		0.8		0.8	0.031
352	UG	1	25	1.64	3.28	9			0.7	0.7	0.022
353	UG	1	25	1.64	3.28	7			0.8	0.8	0.022
354	UG	1	25	1.64	3.28	11		1		1.0	0.054
355	UG	1	25	1.64	3.28	10			0.7	0.7	0.024
356	UG	1	25	1.64	3.28	11		1.1		1.1	0.065
357	UG	1	25	1.64	3.28	11	1			1.0	0.054
358	UG	1	25	1.64	3.28	11			1	1.0	0.054
359	UG	1	25	1.64	3.28	8		0.9		0.9	0.032
360	UG	1	25	1.64	3.28	10			0.8	0.8	0.031
361	UG	1	25	1.64	3.28	9	0.8			0.8	0.028
362	UG	1	25	1.64	3.28	10		0.8		0.8	0.031
363	UG	1	25	1.64	3.28	11			0.8	0.8	0.035
364	UG	1	25	1.64	3.28	12			0.7	0.7	0.029
365	UG	1	25	1.64	3.28	8		0.8		0.8	0.025
366	UG	1	25	1.64	3.28	9			0.8	0.8	0.028
367	UG	1	25	1.64	3.28	12			1	1.0	0.059
368	UG	1	25	1.64	3.28	7	0.8			0.8	0.022
369	UG	1	25	1.64	3.28	11		0.8		0.8	0.035
370	UG	1	25	1.64	3.28	8			0.8	0.8	0.025
371	UG	1	25	1 64	3.28	10		0.8		0.8	0.031
372	UG	1	25	1.64	3.28	9			0.8	0.8	0.028
373	UG	1	25	1.64	3.28	10		0.8		0.8	0.031
374	UG	1	25	1.64	3.28	11			0.8	0.8	0.035
375	UG	1	25	1.64	3.28	12	0.8			0.8	0.038
376	UG	1	25	1.64	3.28	8		0.7		0.7	0.019
377	UG	1	25	1.64	3.28	11		1		1.0	0.054
											14.0
								Total Power Loss			**36.0**

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses:	1	0	12	13

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	0	0	0	13	0	0	13

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.000100 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename: Canning-Street-West-PT

Output Filename: C:\ETAPS\PowerStn\Canning-Street-West-PT\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
AC 110	Load	0.40	100.0	0.0								
Bus1	Load	0.40	100.0	0.0						-0.050		
Bus2	Load	0.40	100.0	0.0			0.033	0.021				
Bus4	Load	0.40	100.0	0.0			0.041	0.026				
Bus6	Load	0.40	100.0	0.0			0.037	0.023				
Bus7	SWNG	0.40	100.0	0.0								
Bus9	Load	0.40	100.0	0.0			0.007	0.005				
Bus10	Load	0.40	100.0	0.0			0.005	0.003				
Bus11	Load	0.40	100.0	0.0								
Bus12	Load	0.40	100.0	0.0			0.018	0.011				
Canning St (W) F-1A	Load	0.40	100.0	0.0								
Canning St (W) P/T F-1	Load	0.40	100.0	0.0								
SVC 135 C St	Load	0.40	100.0	0.0			0.014	0.009				
13 Buses Total					0.000	0.000	0.157	0.098	0.000	-0.050		

LINE/CABLE Input Data

CKT / Branch	**ohms / 1000 m per Conductor (Cable) or per Phase (Line)**							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
1			12.0	1	75	.10600	04000	0003768
10			25.0	1	75	.28100	05000	0002826
12			30.0	1	75	.28100	05000	0002826
13			15.0	1	75	60500	05500	0002512
14			17.0	1	75	60500	.05500	0002512
15			16.0	1	75	.28100	.05000	.0002826
2 or 11			20.0	1	75	.17100	.04500	.0003140
5			25.0	1	75	.60500	.05500	.0002512
6			35.0	1	75	1.63900	06000	0001884
7			30.0	1	75	.17100	04500	.0003140
8			30.0	1	75	.17100	04500	.0003140
9			80.0	1	75	.17100	04500	0003140
Cap			12.0	1	75	.60500	05500	.0002512

Line / Cable resistance are listed at the specified temperature.

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*						

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
1	Line/Cable	Bus7	Canning St (	79.50	30.00	84.97	0.0000007
2 or 11	Line/Cable	Canning St (	Canning St (	213.75	56.25	221.03	0 0000010
5	Line/Cable	Canning St (	Bus9	945.31	85.94	949.21	0 0000010
6	Line/Cable	Canning St (	Bus10	3585.31	131.25	3587.71	0.0000011
7	Line/Cable	Bus11	Canning St (	320.63	84.38	331.54	0.0000015
8	Line/Cable	Bus11	Canning St (	320.63	84.38	331.54	0.0000015
9	Line/Cable	AC 110	Canning St (	855.00	225.00	884.11	0 0000040
10	Line/Cable	Canning St (	SVC 135 C St	439.06	78.13	445.96	0 0000011
12	Line/Cable	AC 110	Bus12	526.88	93.75	535.15	0.0000014
13	Line/Cable	Bus2	AC 110	567.19	51.56	569.53	0.0000006
14	Line/Cable	Bus4	AC 110	642.81	58.44	645.46	0 0000007
15	Line/Cable	Bus6	AC 110	281.00	50.00	285.41	0.0000007
Cap	Line/Cable	Canning St (	Bus1	453.75	41.25	455.62	0.0000005

EQUIPMENT CABLE Input Data

Cable	**Connection**			**ohms / 1000 m per Conductor**								**H**
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R

LOAD FLOW REPORT

Bus Info. & Nominal kV			Voltage		Generation		Motor Load		Static Load		Load Flow					XI
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
AC 110	Load	0 400	98 539	0 2	0.00	0 00	0 00	0 00	0.00	0.00	Canning St (	-0.13	-0.08	225	85.05	
											Bus12	0.02	0.01	31	85.03	
											Bus2	0.03	0 02	57	85.06	
											Bus4	0.04	0 03	71	85.08	
											Bus6	0.04	0.02	64	85.03	
Bus1	Load	0 400	99 879	-0.1	0 00	0 00	0.00	0.00	0 00	-0 05	Canning St (	0.00	0.05	72	0.00	
Bus2	Load	0 400	98.335	0.3	0.00	0.00	0 03	0.02	0.00	0.00	AC 110	-0.03	-0.02	57	85.00	
Bus4	Load	0 400	98 254	0.3	0.00	0.00	0.04	0.03	0.00	0 00	AC 110	-0.04	-0.03	71	85.00	
Bus6	Load	0.400	98.420	0.3	0.00	0.00	0 04	0.02	0.00	0 00	AC 110	-0.04	-0.02	64	85.00	
* Bus7	Swng	0 400	100.000	0 0	0 16	0.05	0 00	0.00	0.00	0 00	Canning St (	0.16	0.05	241	95.70	
Bus9	Load	0 400	99.783	0 0	0.00	0 00	0 01	0.00	0.00	0.00	Canning St (	-0.01	0.00	12	85.00	
Bus10	Load	0 400	99 671	0.1	0.00	0.00	0 01	0.00	0 00	0.00	Canning St (	-0.01	0.00	8	85.00	
Bus11	Load	0 400	99 822	0 0	0.00	0.00	0.00	0.00	0.00	0.00	Canning St (	0.00	0.00	0	0.00	
											Canning St (	0.00	0.00	0	0.00	
Bus12	Load	0.400	98.429	0.3	0.00	0.00	0.02	0.01	0.00	0.00	AC 110	-0.02	-0.01	31	85.00	
Canning St (	Load	0 400	99 823	0.0	0.00	0 00	0.00	0.00	0.00	0 00	Canning St (	-0.01	-0.01	24	84.25	
											Bus11	0.00	0.00	0	0.00	
											Bus11	0.00	0 00	0	0.00	
											SVC 135 C St	0 01	0.01	24	85.02	
											Bus7	-0.16	-0.05	241	95.70	
											Canning St (	0.01	0.01	24	84.26	
											Bus9	0.01	0.00	12	85.03	
											Bus10	0.01	0 00	8	85.06	
											AC 110	0.13	0.08	225	85.26	
											Bus1	0.00	-0.05	72	0.00	
SVC 135 C St	Load	0.400	99 752	0.0	0.00	0.00	0.01	0.01	0.00	0.00	Canning St (	-0.01	-0.01	24	85.00	

* A regulate (constant kV) bus.

# The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltage	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note: * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		Oper. Voltage		Bus		Oper. Voltage		Bus		Oper. Voltag	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note. * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit.

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	in
9	AC 110	Canning St (	-0.1	-0.1	0.1	0.1	2.1	0.5	98.5	99.9	
12	AC 110	Bus12	0.0	0.0	0.0	0.0	0.0	0.0	98.5	98.4	
13	AC 110	Bus2	0.0	0.0	0.0	0.0	0.1	0.0	98.5	98.3	
14	AC 110	Bus4	0.0	0.0	0.0	0.0	0.2	0.0	98.5	98.3	
15	AC 110	Bus6	0.0	0.0	0.0	0.0	0.1	0.0	98.5	98.4	
Cap	Bus1	Canning St (	0.0	0.0	0.0	0.0	0.1	0.0	99.9	99.9	
1	Bus7	Canning St (	0.2	0.0	-0.2	0.0	0.2	0.1	100.0	99.9	
5	Bus9	Canning St (	0.0	0.0	0.0	0.0	0.0	0.0	99.8	99.9	
6	Bus10	Canning St (	0.0	0.0	0.0	0.0	0.0	0.0	99.7	99.9	
7	Bus11	Canning St (	0.0	0.0	0.0	0.0	0.0	0.0	99.8	99.8	
8	Bus11	Canning St (	0.0	0.0	0.0	0.0	0.0	0.0	99.8	99.8	
2 or 11	Canning St (	Canning St (	0.0	0.0	0.0	0.0	0.0	0.0	99.8	99.9	
10	Canning St (	SVC 135 C St	0.0	0.0	0.0	0.0	0.0	0.0	99.8	99.8	
							2.8	0.7			

EQUIPMENT CABLE LOSSES Summary Report

Cable	**Connection**			**Losses**		**% Voltage**		**Vd**	**Vst**
ID	**Bus ID**	**Load ID**	**Load Type**	**kW**	**kvar**	**Bus**	**Load**	**% Drop in Vmag**	**% for Motor**
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es):	0.160	0.049	0.167	95.70 Lagging
Generators:	.000	0.000	0.000	100.00 Lagging
Total Demand:	.160	0.049	0.167	95.70 Lagging
Total Motor Load:	.157	0.098	0.185	85.00 Lagging
Total Static Load:	0.000	-0.050		
Apparent Losses:	0.003	0.001		
System Mismatch:	0.000	0.001		

Number of Iterations: 1

Electrical Transient Analyzer Program

ETAP PowerStation

Load Flow Analysis

Loading Category: Design

Normal Loading

	Swing	Generator	Load	Total
Number of Buses.	1	0	4	5

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches.	0	0	0	4	0	0	4

Method of Solution: Newton-Raphson Method

Maximum Number of Iteration: 5

Precision of Solution: 0.000100 MW and Mvar

System Frequency: 50.00

Unit System: Metric

Project Filename: CL-MissirRoad-DT

Output Filename: C:\ETAPS\PowerStn\CL-MissirRoad-DT\Untitled.lf1

BUS Input Data

Bus Info. & Nominal kV			Initial Voltage		Generator		Motor Load		Static Load		Mvar Limit	
ID	Type	kV	%Mag	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	Max.	Mi
Bus2	Load	0.40	99.8	0.0								
Bus3	Load	0.40	98.9	0.2								
Bus4	Load	0.40	98.8	0.3			0.076	0.057				
Bus5	Load	0.40	98.6	0.3			0.147	0.110				
Secondary	SWNG	0.40	100.0	0.0								
5 Buses Total					0.000	0.000	0.223	0.167	0.000	0.000		

LINE/CABLE Input Data

CKT / Branch	ohms / 1000 m per Conductor (Cable) or per Phase (Line)							
ID	Library	Size	L(m)	#/ph	T (C)	R	X	Y
150 MM2			9 0	1	75	28100	05000	0002826
240 MM2			86.0	1	75	17100	04500	0003140
240 MM2 section-2			63 0	1	75	17100	04500	0003140
400 MM2			11.0	1	75	10600	04000	0003768

Line / Cable resistance are listed at the specified temperature

2-WINDING TRANSFORMER Input Data

Transformer	Rating					% Tap Setting		Imped.
ID	MVA	From kV	To kV	% Z	X/R	From	To	% Tol.

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Bus Numbers ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	% Min. Tap	% Max .Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*						

3-WINDING TRANSFORMER Input Data

Transformer	Rating			Tap	Impedance			
ID	Winding	MVA	kV	%	% Z	X/R	MVAb	% Tol.

3-Winding Transformer Load Tap Changer (LTC) Settings

CKT/Bramch	Bus Numbers ("*" LTC Side)			Transformer Load Tap Changer Setting					
ID	Prim. Bus ID	Sec. Bus ID	Ter Bus ID	% Min. Tap	% Max Tap	% Step	Reg. Bus ID	% Voltage	kV
	*	*	*						
	*	*	*						

REACTOR Input Data

Reactor	Connected Buses		Impedance		
ID	From Bus	To Bus	X (ohm)	X/R	% Tol.

BRANCH CONNECTIONS

CKT/Branch		Connected Bus ID		% Impedance (100 MVAb)			
ID	Type	FromBus	To Bus	R	X	Z	Y
150 MM2	Line/Cable	Bus3	Bus4	158.06	28.13	160.55	0 0000004
240 MM2	Line/Cable	Bus3	Bus2	919 12	241.88	950.42	0 0000043
240 MM2 sect	Line/Cable	Bus2	Bus5	673 31	177 19	696.24	0 0000032
400 MM2	Line/Cable	Secondary	Bus2	72.88	27 50	77 89	0 0000007

EQUIPMENT CABLE Input Data

Cable	Connection			ohms / 1000 m per Conductor								(H
ID	Bus ID	Equipment ID	Equipment Type	Library	Size	L(m)	#/p	T (C)	R	X	Y	R(

LOAD FLOW REPORT

Bus Info. & Nominal kV			**Voltage**		**Generation**		**Motor Load**		**Static Load**		**Load Flow**					**XI**
ID	TYPE	kV	%Mag	Ang	MW	Mvar	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	%
Bus2	Load	0.400	99.788	0.0	0.00	0.00	0.00	0.00	0.00	0.00	Bus3	0.08	0.06	138	80.25	
											Bus5	0.15	0.11	269	80.29	
											Secondary	-0.23	-0.17	408	80.28	
Bus3	Load	0.400	98.942	0.2	0.00	0.00	0.00	0.00	0.00	0.00	Bus4	0.08	0.06	138	80.04	
											Bus2	-0.08	-0.06	138	80.04	
Bus4	Load	0.400	98.804	0.3	0.00	0.00	0.08	0.06	0.00	0.00	Bus3	-0.08	-0.06	138	80.00	
Bus5	Load	0.400	98.583	0.3	0.00	0.00	0.15	0.11	0.00	0.00	Bus2	-0.15	-0.11	269	80.00	
* Secondary	Swng	0.400	100.000	0.0	0.23	0.17	0.00	0.00	0.00	0.00	Bus2	0.23	0.17	408	80.32	

A regulate (constant kV) bus.

The flagged bus has a load mismatch of more than 0.1 MVA.

UNDERVOLTAGE BUSES Summary Report

Undervoltage Buses - Critical Limit = 95 % - Marginal Limit = 98 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltage**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit.
# indicates bus voltages violate marginal limit

OVERVOLTAGE BUSES Summary Report

Overvoltage Buses - Critical Limit = 105 % - Marginal Limit = 102 %

Bus		**Oper. Voltage**		**Bus**		**Oper. Voltage**		**Bus**		**Oper. Voltag**	
ID	kV	% Mag	kV	ID	kV	% Mag	kV	ID	kV	% Mag	kV

Note * indicates bus voltages violate critical limit
# indicates bus voltages violate marginal limit

BRANCH LOADING Summary Report

CKT / Branch		Cable & Reactor			Two-Winding Transformer				
								ANSI Loading (output)	
ID	Type	Ampacity	Loading Amp	%	Capability MVA	Loading MVA	(input) %	MVA	%

BRANCH LOSSES Summary Report

CKT / Branch	Connected Bus Info.		From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		%
ID	From Bus ID	To Bus ID	MW	Mvar	MW	Mvar	kW	Kvar	From	To	in
240 MM2	Bus2	Bus3	0.1	0.1	-0.1	-0.1	0.8	0.2	99.8	98.9	
240 MM2 sect	Bus2	Bus5	0.1	0.1	-0.1	-0.1	2.3	0.6	99.8	98.6	
400 MM2	Bus2	Secondary	-0.2	-0.2	0.2	0.2	0.6	0.2	99.8	100.0	
150 MM2	Bus3	Bus4	0.1	0.1	-0.1	-0.1	0.1	0.0	98.9	98.8	
							3.9	1.1			

EQUIPMENT CABLE LOSSES Summary Report

Cable	Connection			Losses		% Voltage		Vd	Vst
ID	Bus ID	Load ID	Load Type	kW	kvar	Bus	Load	% Drop in Vmag	% for Motor
						0.00	0.00	0.00	0.00

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Swing Bus(es)	0.227	0.168	0.283	80.32 Lagging
Generators	.000	0.000	0.000	100.00 Lagging
Total Demand.	.227	0.168	0.283	80.32 Lagging
Total Motor Load:	.223	0.167	0.279	80.00 Lagging
Total Static Load:	0.000	0.000		
Apparent Losses:	0.004	0.001		
System Mismatch	0.000	0.000		

Number of Iterations: 1